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Science and Technology for Development

Policy Instruments for the Regulation of Technology Imports

STPI Module 6

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STPI MODULE 6: POLICY INSTRUMENTS FOR THE REGULATION OF TECHNOLOGY IMPORTS

CONTENTS

FOREWORD

This module constitutes an integral part of the Main Comparative Report of the Science and Technology Policy Instruments (STPI) project, a large research effort that examines the design and implementation of science and technology policies in 10 developing countries (Appendixes 1 and 2).

The STPI project generated a large number of reports, essays, and monographs covering a great variety of themes in science and technology for development. More than 250 documents were produced by the country teams and the Field Coordinator's Office, and this proliferation posed rather difficult problems during the comparative phase of the project. It was decided that a Main Comparative Report, covering the substantive aspects of the research work of the country teams would be published, and that several monographs treating specific subjects would complement it.

The Main Comparative Report is organized in three parts. The first consists of a short essay covering the main policy and research issues identified through the research, and the second contains the most relevant results of a comparative nature that were obtained in the project. These first two parts have been published by the International Development Research Centre in a single volume in English, Spanish, and French (109e, 109s, and 109f).

The third part of the Main Comparative Report consists of 12 modules containing material selected from the many reports produced during the STPI project. They provide the supporting material for the findings described and the assertions made in the first two parts of the Main Comparative Report.

The modules were prepared by several consultants, and given the diversity of topics covered, the IDRC staff did not consider it desirable nor possible to impose a single format or structure for their preparation. The reader will find a diversity of styles and structures in the modules and will find that the selection of texts reflects the views of the consultant who compiled the module. However, the modules were prepared in close collaboration with the Field Coordinator and were also submitted to a STPI editorial committee who ensured that they provided a representative sample of STPI material. They should be read in conjunction with the first two parts of the Main Comparative Report.

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INTRODUCTION

Technology imports are those imports that effect the technology structure of a country. The technology structure is the current status of (a) embodied technology such as machinery and equipment and (b) disembodied technology such as know-how and brand names. At one level, it is difficult to consider any imports as being outside this definition; at another, it would require a careful analysis of the technology structure. Both these tasks are formidable so that an analysis of the impact of technology regulation has to rely less on empirical analysis than on the expected effect of the policy instrument. Moreover, as will be seen in many of these cases, the policy instrument has not been used over a long enough period of time to calculate its real value. Too often any assessment has to be based on the intentions of the policy makers. Intentions are useful to see the political context in which policies have been generated; they are less useful and certainly more ambiguous in their meaning when it comes to judging their effects. Therefore this group of policy instruments is best considered by detailing their implicit and explicit effects on technology and their expected resource allocation costs and benefits.

Implicit and Explicit Effects of the Instruments

The implicit and explicit effects of the various policy instruments are illustrated in Table 1.

The various instruments are listed on the left, and a crude distinction is made between technology and nontechnology factors on the right. Within technology there is a distinction between embodied and disembodied technology. This merely shows, from the documents considered for this module, the expected effects that the instruments are likely to have on the economic and technical structure. Such tables are a matter of judgment and it would be possible, although not very fruitful, to fill all the boxes with X's. Rather, this mark is to be interpretated as a strong indication of influence.

Two features become apparent from this table. It would seem that, of all the instruments, DFI (direct foreign investment) controls are the most effective, and that technology and nontechnology factors have an equal number of instruments. However this table disguises as much as it illuminates. First, instruments like that of DFI controls have multiple tradeoffs because they have multiple objectives. Second, the table does not show the weight of either the instruments or the structures that they are meant to modify. Foreign trade and investment are, for example, two of the most important means by which growth takes place. The nontechnology sector may therefore be more important than the technology sector for certain growth objectives. However the table also shows that with many of the instruments technology objectives are mixed up with the other, perhaps more important, objectives. Thus imports, joint ventures, and DFI controls will affect more than just the technology structure. Policymakers have to keep such multiple effects in mind when wishing to alter the technology structure.

Costs and Benefits of the Instruments

Costs and benefits are best analyzed by taking a market model. The instruments dealing with the regulation of technology imports set out to interrupt the free flow of resources between the developing country and the rest of the world. Such a policy has costs and benefits.

The costs of interrupting the free flow of resources mainly affect prices, efficiency, and technical progress. First, the interruption of imported goods by restricting demand through import permits and tariffs leads to scarcity. The internal price of the scarce good is increased relative to the pretariff or permit price. This is acceptable if either the nation has no interest in international trade or its controls are selectively chosen for particular goods. Even in the second case, the margin between the domestic and world price becomes a new matter of policy concern when the gap is

either increasing or shows signs of diminishing. As both a product and an input into domestic manufacture, its price has risen when compared with world alternatives. Second, because most developing countries have small product markets, particularly technology product markets, the slow growth of the market and the lack of domestic competition can lead to inefficiency. The producers are guaranteed a share of the market because of the results of protection and do little to improve their production system. Third, for similar reasons, the producers have no stimulus to improve their product and see little or no reason to invest in technical progress. The result can be overpriced, overprotected, and technically obsolete products. For much the same reasons, many developing countries such as Brazil have emphasized the importance of export-led growth as a solution to these well-intentioned results.

The benefits of the regulation of technology imports have to compete with the costs. The benefits include the protection of infant industries, balance-of-payments savings, an increase in potential employment, and possibly the growth of domestic technical capacity. Infant industries, which could not compete with imported products, can learn to do so and become competitive. They can then jump the protection wall and enter the real world. Import controls and a reduction in the natural growth rate of foreign investment and technology rents can diminish industrial balance-of-payments costs. Reducing the inflow of new machinery can encourage a greater use of domestic resources, particularly labour, and because technical problems always exist, their solution by domestic technicians could result in indigenous capacity for resolving technological problems.

The choice is never ambiguous but it exists. Those who doubt the possibility of obtaining benefits from the regulation of technology imports should ponder Japan's history. But all is a matter of degree and sometimes luck. A shift in world trading conditions, as happened after 1973, can alter the value of policy instruments. No policy instrument stands apart from the society in which it is going to be used or the history that has made that society. Major trading nations have difficulty in applying import controls because of possible discrimination; nations with substantial direct foreign investment are unable to apply new rules easily for fear of discouraging new investment. Technology structures also have a life of their own, with built in expectancies and needs. Moreover, technical structures take time to alter. The instruments are long term. Many of the instruments apply most usefully to new investment, but if that investment, because of a lack of confidence, is not forthcoming there may be no long-term but a series of short-term policies.

Political Conditions

The effective use of these instruments depends on appropriate political conditions and governments with enough support to insist on their application. These conditions are important for the following reasons:

(a) Administrative Coherence: If governments have no set of priorities, then the instruments become difficult to apply. Such priorities must be specified not only for policy but bureaucratically. Such policy coherence has bounds of tolerance that depend not only on the ability to rank instruments but also on their internal bureaucratic arrangement.

This is very clear with instruments that have only a technology application. Where registries, for example, are isolated from the network of agencies that should apply their decisions, then their role is simply that of another bureaucratic irritant without identifiable policies or power. Moreover, where instruments have more than one application, technology considerations are often ranked under these other applications. Import controls, for example, are such powerful and relatively facile instruments to apply that governments will often use them without any consideration as to their technology applications. Indeed there may be an inverse relationship between government policy and bureaucratic coherence and the application of powerful instruments. The difficulty of refining policy may be so complex in terms of political and bureaucratic agreement that only the big guns have any validity. Such is often the case when nations are faced with major balance-of-payments problems.

A further example of administrative coherence exists when the government itself is an industrial producer. State companies, as some of the studies have shown, often feel that rules for the control of technology imports apply to the private sector only and not to them. Nevertheless, one positive aspect of these rules is to allow the state

to participate as a partner in technology negotiations. This is most clearly seen in the joint ventures.

(b) Cooperation Versus Conflict: The attempt to introduce some of these instruments, whatever their national or economic justification, has often led to political conflicts. These conflicts have not only been between the private sector and the government but within the government itself. One of the results of bureaucratic incoherence is that certain government sectors see little or no validity in classifying technology instruments as something separate or independent. The holders of traditional instruments (fiscal and financial), such as the central bank of the finance ministry, often fail to support or actively oppose the application of technological criteria.

A greater challenge is faced when governments try to apply measures to already established foreign investors or firms. Great skill is required to calm worried executives and maintain investor confidence. Apart from the problems that many companies could create through their international lobbying power, most developing countries need the investment and technology of foreign firms. The issue is, and always will be, on whose terms.

International Equity

The last point, investment and technology on whose terms, is the most important achievement of these instruments. The attempt to apply many of these instruments may not have been as successful as the early proponents argued. But through their operation developing countries have come to see that only by bargaining and obtaining more information can they hope to redress their current imbalance with the rest of the world. Many of the registries of licencing agreements have come to understand the importance of bargaining and their example has been followed by other developing countries. Indeed one of the successes of the instruments has been in world rather than in national terms, for they have served as living experiments, successful and unsuccessful, for other countries to profit from and understand.

Although many of these instruments remain passive rather than active, defensive rather than innovative, they are answering a continuous requirement of poorer countries, the requirement to defend their perceived national interests.

THE CONTROL OF TECHNOLOGY IMPORTS

Technology imports are a subset of all imports and the control of technology imports is a special case of import control. This section deals as much with import controls as with technology imports. Both have an effect on technology. Import controls have an implicit effect on the type of technology, while technology imports per se are intended to have an explicit effect on the domestic structure of technology. The need to move from implicit to explicit technology import controls is one of the major themes found in this section. The change of emphasis has been both difficult and slow. The search for a specifically technological view of import controls involves a distinct view of how imports affect the technological structure as well as a deeper understanding of the role of import controls as a policy instrument.

Import controls - as distinct from technology import controls - have relied on an array of instruments whose objective is to discourage certain types of imports. The choice of what to discourage is often dependent on the particular phase of economic policy. Thus countries trying to build up local industrial capacity have used import controls to protect these industries. During the 1950s, when many of the STPI countries were trying to build up their consumer goods industries, they protected these industries - domestic durables, clothing, footwear - by not permitting import competition. By not allowing the import of consumer goods or by increasing their imported price relative to domestic alternatives, countries were able to provide local industries with both a comparative advantage in the domestic market and the possibility of developing their products for a protected market. Such strategies came to have a raison d'etre of their own so that import substitution industrialization (ISI) became one of the key policies for industrialization strategy.

The first three subsections deal with traditional import control instruments - customs tariffs, import permits, and foreign exchange control mechanisms. These

instruments continue to play a crucial role in setting policy for both developed and developing countries. There are few instruments either so powerful or so easy to apply. Governments have tended to apply them for a variety of motives and policy objectives that lie between protecting special interest groups and coherent economic strategy. Moreover, import control mechanisms have another advantage, particularly when compared with the other instruments found in this section: they have almost immediate application. Import decrees normally lie within the power of the government and can, if needed, be changed from day to day. Therefore import controls have both a short-term and long-term application. A government may establish its import regulations with an eye to the long term, as for example with an ISI strategy. World economic conditions, such as a deterioration of the balance of payments or currency fluctuations, could make the government decide to alter import regulations quickly to resolve the short-term rather than the long-term problem. Moreover, there is no guarantee that the short-term measures will be in harmony with the long-term strategy. Import controls therefore become a double-edged weapon. They can be a powerful stimulus to industrialization but can be abused by domestic industry to maintain their competitive monopoly in the national market; they can have long-term objectives intended to contribute to national economic policy but can be used to resolve short-term, principally balance-of-payments, problems.

Import controls are therefore an inherently ambiguous weapon. This statement can be demonstrated by examining the first three subsections. Import controls can contribute to the overall policy of a government, as the description of Venezuela shows, but the table found there assumes stable government strategies and policy coherence. Too often, however, this strategy is difficult to apply or governments are unable to use import controls in the way that they first intended. One result, to be found in the following description of Mexico, is overprotection, where the customs tariffs reflect nominal rather than real values. The calculation for Mexico of nominal and effective tariffs shows that the real import price - and therefore real protection - is higher for durable and capital goods than a reading of the nominal rates would suppose.

Import permits exaggerate the points made above. A highly flexible instrument, they apply to specific rather than classified categories of imported goods. The subsection on import permits suggests that this has become a major instrument for industrial protection. Apparently, over 50% of imports in Korea are protected in this way, while the percentage of Mexican imports subject to import permits amounts to two-thirds. In both countries import permits are decided in association with industrialists or manufacturers associations.

The third traditional category of import controls depends less on the type of good than on the availability of foreign exchange. Although both Peru and Colombia, described in the third subsection, have import permits and customs tariffs, the STPI investigators place special emphasis on the importance of foreign exchange considerations for import decisions. In Colombia the mechanism is used case by case; in Peru foreign exchange is set by company, not by requested product.

Both show the complexity of the issue for developing countries; imports are not just a question of domestic but of foreign resource allocation. Foreign resource allocation depends on factors that a government may not be able to control or even foresee: world trade conditions, comparative currency depreciation, financial reputation, and alternative currency uses.

The effects of import policies on industry are sometimes unclear, whatever the original intention, and are best understood historically. Governments, like that of Brazil, have found that they need to change their import policy and therefore the use of their instruments. The description of Brazilian policy since 1945 shows how import controls have to respond to a number of different policy issues.

First, import controls can be used for protection or for balance-of-payments reasons. Second, continued protection of domestic industry can lead to overprotection and inefficiency, particularly when judged by world market prices. Finally, the description shows how it is possible to develop new instruments - such as minimum value lists - with the intention of providing flexibility and discrimination for import controls.

The search for more precise instruments was a result of analyzing the real effects of ISI on domestic industry. Too often it seemed that domestic industry required continuous rather than initial protection. Infant industries had grown to become pampered teenagers. Encouraged to sell to a domestic market, they seemed unable to sell anywhere else. In world terms they were uncompetitive. As countries came under balance-of-payments

pressures, governments began to expect protected industries, particularly in consumer goods fields, to export their products and so earn foreign currency. The dual concerns of import policy - protection and balance of payments - came to be seen as resolvable by changing the role of protection policy.

These general points are examined in more detail in the remaining subsections. Government policy changes in import policy for the machine tools sector in Brazil - a crucial sector - are described first. Few sections illustrate better the complexity and ambiguity of the instrument. Although intended to deal with technology imports, it is not clear that the policies were any more successful than import policies per se. The implicit results of import policies on technological behaviour are to be found in the description of Mexico, where the survey shows that overprotection differs by sector and product. Import protection does not seem to have resulted in more independent policies, but rather in corporate behaviour specifically geared to import advantages for capital goods and market structure. Finally, even though Venezuela is a special case because of its oil wealth, the overall assessment for a country without balance-of-payments constraints seems little different from those that have current account deficits.

None of the descriptions suggests that protectionism was or is unimportant. Rather, it would appear essential. However, protectionism has resulted in policies that do not take account of their technological effects and has been used as much for short-term and special interest needs as for long-term strategy.

Customs Duties and Tariffs

Policy Objectives (Venezuela)

In general terms, customs duties can fulfill two functions whose importance varies according to the characteristics of the economy in which they are applied. The first of these objectives is of a fiscal nature: the state obtains part of its revenue by means of the duties levied. The second is of an economic sort: the duties are used as a policy instrument especially in the case of conjunctional situations. In this last sense customs duties can also be used in two ways:

(1) They are lowered to aid the price stability of certain products to guarantee supply or to contribute to or improve resource allocation.

(2) Inversely, they are increased to protect internal economic activities of a given sort, to reduce deficits in the balance of payments or to stimulate expansion in employment levels (Table 2).

Effective and Nominal Rates (Mexico)

As in most developing nations, the Mexican industry enjoys a considerable degree of state protection against foreign competition, much more than the nominal tariff levels seem to suggest. A comparison between nominal and effective protection can indicate these levels of effective protection, as shown in Table 3.

The most prominent difference between nominal tariff protection and effective implicit protection is in the machinery groups. In the case of fertilizers and synthetic fibers (which are included in the first group of intermediate products) and dairy products (included in processed foods), the levels of protection are maintained below average.

Various general comments can be made about this Mexican tariff system: (a) considerable levels of overprotection exist and could be eliminated without negative effects on production; (b) the Mexican tariff has principally tended to protect the production of consumer goods and to establish a liberal policy for the import of intermediate and capital goods (moreover, by virtue of Rule 14 of the General Import Tax, imports of capital goods enjoyed an exemption of 65%); (c) consequently, there is discrimination against manufacturing activities in the capital goods sector (and even against certain activities, such as mining, in the primary sector); (d) in the past, the system has responded more to the pressures of the better-organized entrepreneurial groups than to the outlines of any policy of industrial development; (e) it is probable that the system has encouraged high levels of idle capacity in some sectors and extremely high cost structures with all their implications for the production structures in various industrial branches.

In summary, the protectionist system has had one consequence of great relevance

on the technological knowledge that previously was implicit in the goods whose importation it was hoped to substitute. From this point of view, the tariff system is one of the instruments that has had an important impact on the technological development of the country. It cannot be forgotten that in its beginnings the protectionist system did not attempt to reorient the structure of production or affect the composition of demand: the patterns of consumption inherited from the "outward" model of growth were kept intact by the protectionist system. Hence, the extremely high sum of payments abroad for royalties and technical assistance in the branches of durable and nondurable consumer goods is not surprising.

Import Permits

Direct Quantitative Import Restrictions (Korea)

Just over 50% of the total number of items on the trade classification table in Korea are subject to import licences. Compared with differentiated tariff rates, those restrictions were considered by the Korean team to be a negative technological development. Under the tariff protection system, if domestic producers do not meet essential quality requirements, imports can still enter paying high tariff rates. But the Korean team pointed out that quantitative restrictions completely shut off foreign competition and the pressure for technological improvement.

Moreover, in Korea, import licences are granted on the basis of recommendations made by domestic manufacturers associations. In the case of noncompetitive raw materials imports, the association of manufacturers using them decides how much each firm will import. This is essentially an effective cartelization of domestic process, resulting in the elimination of competitive pressure for technological development.

In the case of competitive imports, the import licences are granted on the basis of recommendations made by associations of domestic producers of the goods in question. This also removes the pressure of competition from abroad, according to the Korean team. The users of such imports are often forced to use low-quality products of domestic producers, which amounts to forcing consumers to subsidize producers without applying any pressure on the producers to improve their performance.

Import Permits (Mexico)

In 1960, almost two-thirds of the tariff items were covered by the system of import licences. In those cases where implicit protection is greater than tariff protection (once taxes - or lack of them - on inputs are taken into consideration), quantitative controls play quite an important part. The instrument functions as follows: on application from an institution or individuals, the Ministry of Industry and Commerce can issue permits for importing goods subject to restrictions or prohibition. In principle, authorization (or denial of the permit) is granted on the basis of the following criteria: that goods not produced in the country are involved; that national production does not completely supply the internal market; that a temporary scarcity of the item must be relieved with imports; or that national goods cannot replace foreign goods in terms of prices, quality, and opportunity for delivery. In practice, the Ministry manages this instrument with enormous discretionary power, and it is recognized that the evaluative capacity of the authority responsible is very small in face of the number of applications. In sum, the instrument has created a highly protected environment for local industry; in fact, many products are found in a situation where nominal tariff protection exceeds nominal implicit protection (that is, they are overprotected) and, moreover, they are subject to the import-licencing system.

Foreign Exchange Control Mechanisms

Payments Abroad (Colombia)

In principle, the system for payments abroad in a given country can be free or it can be subject to government control. In Colombia (as in several Latin American countries) all exchange activities are subject to government control in agreement with Decree 444 of 1967 and other dispositions that have modified and complemented it. It is very probable that the country must continue with a system totally controlled in its exchange and foreign commerce operations for a prolonged period.

(a) Types of Exchange: Traditional exchange rates were considered fixed in time

except when they were submitted to sudden changes through so-called devaluations. In 1967 this concept was modified in Colombia, and the idea of variability in exchange rates was established in accordance with supply and demand on the market, with no handicap of government control over that market.

In some periods in some countries, various types of exchange have been used for importing different types of merchandise. In a certain way, this has an economic effect equivalent to that of tariffs but undoubtedly constitutes an inconvenient distortion. Within the Andean Group and for the application of the Common Foreign Tariff, an attempt will be made to eliminate the multiple exchange rates within each country.

(b) Tax on Money Orders: In Colombia there is a 12% tax on money orders to other countries. This tax affects imports of redeemable goods, which must be paid for with exchangeable funds on a short-term basis. Goods imported under other conditions (non-redeemable ones) are not affected evidently by this tax.

(c) Other Taxes on Monetary Transfers Abroad: The tax laws of some countries apply to monetary transfers abroad under the presumption that all of them contain an element of payments within the country by the recipient abroad. This is the case in Colombia, where the presumed earnings of payments abroad are taxed by a percentage of the amount of the draft.

All the types of taxes that weigh on drafts to other countries affect not only machinery imports, which must be reimbursed, but all other payments, even those caused by such intangible purchases as royalties and technical aid. If the total percentage of the application of these taxes is greater than the use of tariffs and the other ad valorem factors for equipment and raw materials, the importer of technology and goods may prefer to transfer the cost of the technology to the bill for the goods themselves, with the agreement of the exporter abroad.

(d) Control of Contracts and Payments for Technology: This instrument was established in Colombia in a very original way in 1967 (Decree 444/1967) when the Royalties Committee was created. Later it began to be adopted by other Latin American countries. It was especially embraced by all the countries of the Andean Group in Decision 24 (Statute for Foreign Capital and Technological Transfer). Its importance is very great.

The Foreign Transactions Board (Peru)

This is an institution pertaining to the Peruvian economy and finance sector that regulates the allocation of foreign exchange to the private sector as a whole for productive or commercial ends. A legal provision gives the Board power to control the foreign exchange used by the private sector. As such, it is an implicit instrument whose function is to control the volume of imports of each of the enterprises of the private sector, approving the amounts of foreign exchange available in accordance with the objective of the General Development Plan and with the established industrial priorities.

The objective of this law is to achieve a rational distribution of the foreign exchange resources according to the government development project and the priorities set forth in the Development Plan. The functions attributed to the Board are:

(1) To prepare the foreign exchange budget for the private sector.
(2) To approve, on the basis of the processed information furnished to it by the Central Bank, the annual quantity of imports for each enterprise.
(3) To provide the Monetary Policy Council with the necessary information to be able to adapt the annual expenditures in foreign currency to the national resources.

This instrument is complemented by and acquires meaning within the established foreign exchange control policy. It is also complemented by the group of import control instruments: import licences, national list of manufactured goods, prohibited goods, etc.

In practice, the allocation of foreign exchange for imports is made on the basis of the pragmatic criterion of what has historically been the normal requirement of the enterprises, with an increase in the quota considered if an increase in production is programmed. When there is a scarcity of resources, from which the Peruvian economy cyclically suffers, the state prorates the cuts according to the availability of funds. Enterprises usually try to justify needs greater than the real needs, to obtain an amount that is close to their objectives. The rational and selective control therefore takes a second place to the saving of the maximum quantity of foreign exchange possible.

Furthermore, the allocation is made by enterprise and not by imported product and therefore the enterprise is able to make use of the foreign exchange granted as it sees fit, with the sole exception that the products included on the list of prohibited goods are restricted.

Import Control Policy Choices (Brazil)

Developing countries generally use several instruments for the protection of domestic production, the commonest being related to exchange policy, adoption of non-tariff restrictions, and customs tariffs themselves. It is obvious that the degree of protection varies according to the utilization of each one of these, or simultaneously of more than one of these instruments. But more often than not tariffs become the most important one. In the course of the 1950s and in a large part of the 1960s the customs tariff, together with quantitative restrictions on imports and differentiated exchange rates, gave a high degree of protection to the Brazilian domestic production. However, to the extent that a phase of import substitution was being completed, a reduction in the degree of effective protection would have been convenient. First, it was a means of forcing domestic industry to reach a higher degree of efficiency by subjecting it to international competition. Second, as the rate of domestic inflation was higher than the international one, it was a means of checking the rise in prices. And, finally, the change in the emphasis of economic policy itself - from import substitution to export promotion - can be damaged by an indiscriminately high tariff and by the existence of broad restrictions on imports.

In this way, Brazilian industrial growth in recent years has been followed by a liberalization of imports. At first, after the abolition of practically all the most important nontariff restrictions, a general fall in tariffs was carried out in 1967. Tariffs were, however, raised again in late 1968 for balance-of-payments reasons; a selective liberalization was still kept, based on the priority ordering of imports and the granting of exemptions. Parallel to this the government reformulated the exchange policy. The gradual simplification of the exchange market from 1965 on culminated in the extinction of multiple exchange rates. In late 1966 the Central Bank established that the importation of products that made up the special category should pass to the general category as from March 1967. The customs tariff thus remained as the only instrument of protection. And the reduction set up as from March 1967 in reality brought about a substantial liberation of imports. The rates, which had previously varied between zero and 150% (surtaxes not included), would henceforward vary between zero and 100%. The overall reduction reached an average of about 28%.

Moreover, systems of exemptions aimed at benefiting certain kinds of imports were created or enlarged. Certain products could now be imported with exemption or reduction of the import tax, the amount to be imported being limited to a quota, established as a proportion of the part to be purchased in the domestic market. As to the exemptions, besides those that benefited the projects approved by the Council for Industrial Development (CDI) and the implementation of drawback rights, the Council of Customs Policy (CPA) began directly to grant a reduction of 50% in the import tax that fell upon machines and equipment without domestically produced similars. CPA's function of granting exemptions or reductions of the import tax as an economic stimulus was also regulated. If to all this is added the effects of periodic exchange overvaluations, which remained up to August 1968 (when the flexible exchange rate was adopted), and of the resumption of economic growth itself, the fast growth of imports as from 1966 will be easily explained.

The rationality of this liberalization of imports was based on the assumption that domestic industry should be subjected to international competition as a way of forcing it to take better care of its production costs and not to raise its prices without due reason, at the same time as it should try to reach better levels of productivity. In this sense the liberalization would be an additional important piece in the mechanism of the anti-inflationary fight, which was at the time one of the central aims of economic policy. But protection was not totally abandoned. The same legislation that was the basis of the liberalization policy established the so-called list of minimum value, according to which goods imported at prices markedly below the normal ones in the international market would be subjected to the ad valorem taxes applied to the minimum prices established by CPA, and not to the prices shown in the invoices: it was thus a weapon against dumping. However, this mechanism was only to be applied as from mid-1969, and even so for a short time, in view of the inefficiency it showed.

In late 1968, due to balance-of-payments difficulties, a change took place in the

liberalizing trend described above. The adoption of the flexible exchange rate reduced the effects of encouragement to imports stemming from the long periods of exchange overvaluation, and CPA began to develop a more effective activity in the protection of domestic production. In August 1969, together with the reorganization of CPA itself, the mechanism of the list of minimum value mentioned above was implemented. This mechanism, however, revealed itself to be insufficient, which led to the adoption of the system of reference prices. According to this system, taxation was now based on minimum prices calculated as a function of production costs in the producing countries, of the wholesale prices in those countries, or on the basis of recent historical price series (importation), and the tariff became partly specific (the difference between the reference price and the invoiced price) and partly ad valorem (the result of the multiplication of the established percentage by the reference price). This mechanism has been, and everything indicates it will go on being, the instrument of protection to domestic production against measures of dumping. The tariff itself was now higher vis-à-vis the levels prevailing in the liberalization promoted as from March 1967; there was an average rise of over 25%, but it was still below the levels of 1964-1966, except for consumer goods (durables and non-durables) and metallic intermediate goods. Nevertheless, it is important to qualify the degree of protection stemming from this nominal tariff.

In fact, the growing utilization of systems of incentives (chiefly to exports and to industrial development) based on exemptions and reductions of the import tax implies a lower real tariff, which gives Brazil's present tariff policy in reality a character of selective liberalization. Tax benefits affect in a larger scale capital and intermediate goods: the former through the incentives administrated by CDI and regional development bodies, besides sectoral incentives and those to specific industries, which have been dealt with in innumerable resolutions of CPA; and the intermediate goods mainly by means of the mechanisms of conditioned importation and of the drawback rights. Furthermore, exchange readjustments, generally slightly belated in relation to the evolution of internal prices (even if the evolution of international prices is taken into account), have contributed to reduce effective protection. At the same time, the bureaucratic procedures for import operations were simplified. In August 1970 the import licence was done away with, and a new form was introduced; imports were classified between those that depend and those that do not depend upon a permit, and the import of some kinds of goods was forbidden. Soon after that, in May 1971, CACEX (Foreign Trade Department of the Bank of Brazil) consolidated in a single consultative instrument all import mechanisms. An effort was made to show that to import is not difficult, as is suggested in the title of a leaflet issued by CACEX itself.

Thus, this liberal-selective import policy can be considered as a continuation of the one adopted in March 1967, being well-adjusted to the policies of export promotion and of incentives to industrial development. Its efficiency, however, depends directly on the criteria used in the granting of tariff exemptions or reductions. And it seems that in recent years it has been misused, at least with respect to the exemptions for imports of capital goods. These goods contributed with about 77% to the rise of the import coefficient between 1968 and 1972, which represented one of the factors that contributed to the relative backwardness of the domestic capital goods industry.

The Technology Effects of Import Controls

Government Policy in One Sector: Machine Tools (Brazil)

Three government policies are worth examining in connection with the early development of the Brazilian machine tools industry: (a) the equipment import prohibition of the 1930s; (b) the exchange policy of the post-World War II period; (c) the foreign capital up to 1955.

In (a), a prohibition to import equipment for the industries considered to be in a state of overproduction, enacted by the government in 1931, was in all probability instrumental in bringing about the initial nucleus of the machine tools industry in the 1930s (1). The prohibition, established for a period of 3 years, was later extended, so that it was in force up to 1937.

The immediate justification for this measure was the balance-of-payments crisis brought about by the Depression, and the consequent need to keep imports under control. However, the lobby of textile mill owners was one of the main forces behind it: plagued by excess capacity for years, they wanted to take advantage of the rapid increase in demand that was taking place, without being bothered by new entrants. According to the

prohibition decree, a government department was empowered to recognize a state of overproduction in a given industry; promptly the most important sectors were considered in such a state (textiles, food, footwear, hats, etc.), and machinery imports were drastically curtailed.

The effects of the prohibition upon the domestic production of machinery can be evaluated by the evolution of the textile equipment industry over the period. This incipient activity received a vigorous impulse from the demand shift toward internal production: the number of firms registered in the state of Sao Paulo as producers of textile equipment jumped from six, with 75 workers, in 1929, to 14, with 43 workers, in 1937. And from 1930 and 1936 the largest producer of looms increased its monthly output from 30 to 130.

Even in the absence of comparable information about domestic machine tools production, it is certain that this activity enjoyed a similarly favourable period. The import prohibition brought about increased utilization of existing capacity and delayed replacement in all industries to which it applied, most notably the textile industry, which doubled its output from 1930 to 1937, with marginal increases in installed capacity. This naturally caused an increased demand for repair and maintenance services, with positive effects on the demand for machine tools.

Copying foreign models was - and, to a large extent, still is - the standard means of designing a new model for domestic production. The imported machines are disassembled, and an effort is made to reproduce their parts, if possible using the same material; when necessary, simplifications or adaptations are performed. It is probable that in the initial stages of development of the industry the copying process would sometimes be crude, and the final product lacking in precision. However, the type of demand to be satisfied was such as to make mechanical exactness unnecessary, especially in the presence of obstacles to importation. Copying was, therefore, an effective way to absorb know-how from abroad.

World War II marked an extension of the period of import difficulties. There are indications, however, that lack of imported materials, especially steel, exercised an offsetting influence on the development of the domestic production of equipment.

In (b) above, after World War II, exchange regulations appear as the main policy instrument affecting the industrialization process. While the effect of the adopted policies favoured the internal production of consumer goods, domestic equipment production was hampered by the preferential treatment given to imports in this category.

Immediately after the War, there were no obstacles to imports, even though the fixed exchange rate was rather overvalued. With the rapid exhaustion of the country's international reserves, the government opted for a direct control of imports rather than a devaluation, partly with the purpose of avoiding inflationary pressures. Foreign exchange was allotted to importers according to criteria based on the essentiality of the goods to be imported. By and large, machinery and some inputs were attributed high priority, while luxuries and goods that could be produced internally were penalized. The system was, thus, doubly favourable to the internal production of difficult-to-import goods: protection from external competition was assured, and at the same time it was possible to import the necessary machinery at an overvalued exchange rate. By the same token, however, domestic production of machinery was discouraged. This effect was felt in the machine tools sector, and some firms were forced to abandon this line of production. By 1949, 68.9% of the value of the internal supply of metalworking machinery corresponded to imports.

The rapid growth of industrial output in the early 1950s, on the other hand, created a derived demand for machine tools, resulting in a renewed interest in local production. In 1955, total Brazilian output of machine tools was about 4,500 units, and imports corresponded to only 34.7%, in number of units, of internal supply (and 53.9%, in weight).

In (c) above, it could be asked whether the predominantly national character of the machine tools industry would have been affected by government policies that had the effect of repelling foreign capital. It turns out, however, that the policies adopted in this respect before 1955, even if they were not markedly attractive to the foreign investor, would not, by themselves, check the inflow of capital. In this period, the main manifestation of foreign capital policy was represented by limitations to capital repatriation (20% a year) and to profit remittances (8% a year), which had been

established in the 1930s during the Vargas dictatorship. After the War, those limitations were repeatedly cancelled and then applied again, according to changes in the balance-of-payments situation. In general, periods of absence of restrictions prevailed, so that the relatively low level of foreign investment, in the period, could be attributed more to external factors (post-War reconstruction period) than to the lack of an adequate climate.

As far as the machine tools industry was concerned, the exchange policy tended, in any case, to direct investment to the more protected sectors, and the models of higher technological content, in which foreign producers would have a clear advantage, were being imported without restrictions.

To sum up, the early development of the machine tools industry was marked by the production of domestically developed models (in a sense), with the predominance of nationally owned firms. These characteristics, even though affected by various government measures, were not the result of deliberate policies.

Technical Effects on Firms in Three Sectors (Mexico)

The effects of the protectionist system on the technological decisions of the productive units vary in each branch (capital goods, petrochemicals, foods). For the capital goods industry, the most important effect is that the low tariff levels on imports of machinery and equipment, as well as existing exemptions, have blocked the development of this branch.

Of the firms visited, 10 considered that the market for their products was currently quite small, fundamentally because of the volume of foreign imports. In the case of the agricultural machinery industry, the sharp contradictions of an industrial policy without criteria regarding priorities are quite evident. There are four firms manufacturing tractors: three subsidiaries of transnational corporations and a public firm that produced two different models under foreign licence. The two subsidiaries that were visited had their programs of manufacturing approved by SIC (that is, they received certain exemptions and their products were subject to the previous permit system), but their production volumes were established on the basis of quotas assigned by SIC and an official price has been fixed for agricultural machinery. The extremely defective industrial programming in this sector has made it necessary to fix production quotas for each firm, price controls, and, at the same time, agricultural machinery is exempted from the General Import Tax. (This seems like an exaggerated measure if one considers that an increase in the import of machinery is not an indispensable requirement for raising agricultural production. Moreover, the commercial agriculture that can acquire this type of machinery has sufficient capacity available to cover an adequate tariff). The installations of the firms visited produce approximately 2,500 units annually and sacrifice the advantage of producing on a larger scale: in fact, both have had to diversify their production to deal with the problem. The exports of these two firms are marginal, fundamentally because their prices are not competitive (2). In this industry, all the technology (and the trademarks) come from external sources, and only minor adaptations have been made to the machinery.

In the construction machinery industry, firms manufacturing lighter equipment (mixers) indicated that the internal market was sufficiently large and that protection levels were adequate. Yet, the manufacturers of heavy equipment (excavators, front loaders, hydraulic and mechanical cranes, etc.) do indeed face a narrow market, which has negative repercussions on their scales of production, and their export possibilities are quite limited (the average of their exports is no greater that 11% of production). As in the case of agricultural machinery, the technology and trademarks come from abroad, and although some technical activities (and even experimental development) are carried out, it would seem that in these cases the reduced scale of production does not favour the development of research activities that could result in their own designs. This situation offers a significant contrast with that of the manufacturers of equipment and machinery for the process industries, which face a much broader market (and which have great possibilities for diversification).

For the manufacturers of machine tools, the market appears narrow, fundamentally because of the ease of importing this type of capital good. In the past, application of Rule 14 and other exemptions negatively affected programs of expansion in this industry. Moreover, tariff levels have traditionally been low for this and other machinery. And although many of the firms visited had manufacturing programs approved by SIC, in practice

it turns out to be quite difficult to control imports of machine tools effectively: the specifications of a lathe or a press can be modified (in such a way that it remains outside the protection offered through a manufacturing program), or its parts can be imported separately and assembled afterward (3). Furthermore, there is competition from machine tool manufacturers in Argentina and Brazil, who have readily taken advantage of Mexican concessions on these goods within the framework of the Latin American Free Trade Association (LAFTA).

These concessions have made Brazil one of the most important foreign suppliers in this field because of its higher level of development in the capital goods branch. It is not surprising that within the three complementary agreements between Mexico, Brazil, and Argentina on capital goods (on equipment for offices, for generation of electric power, and for refrigeration), the balance would be exaggeratedly negative: 1 million pesos exported to these countries against 73.9 million pesos imported from them in 1973 (4).

This situation has obliged the firms in this industry to diversify their lines of production, in many cases strengthening their ties with foreign sources of technology and with detriment to a specialization that would enable them to raise levels of productivity and quality: 11 of the 14 companies in this industry had to diversify their lines of production because of the reduced size of the market, and the average level of capacity utilized in these units scarcely reached 60%.

Furthermore, the tariff on machine tools has peculiar characteristics that can encourage the selection of more capital-intensive techniques. The official price has to be calculated over the fiscal weight in such a way that the true level of protection can only be known by analyzing the official price for each item. This is an excessively laborious task, and only certain tariff headings are examined in detail. Table 4 presents existing tariff levels and official prices for certain types of machine tools (whose use is widespread in almost all branches of the manufacturing industry). It can be deduced that importing a semiautomatic machine (or even one that requires more labour) costs more than a totally automated machine, which displaces labour. Indeed, in the case of an overprotected industry, it turns out to be more convenient to import a machine with numerical control, which can remain underutilized while it is depreciated at an accelerated rate for fiscal purposes under the coefficients authorized by LISR. The reason is obvious: the official price per fiscal kilogram is 80% lower. Furthermore, it also proves more convenient to acquire a complex machine (of the transfer type) that incorporates the operations and movements of two or more machine tools in one: in this case, although the tariff would be the same, the weight of the complex unit would be less than that of two or more machine tools.

In the petrochemical and food industries, the protectionist system does not seem to have had an important effect on technological decisions by the firms. The raw materials and intermediate inputs of these industries have always been subject to relatively low tariff control (5). Moreover, in the case of the petrochemical industries the raw material is provided by PEMEX (Petroleos Mexicanos) at prices not very different from those prevailing on the world market, and in some cases this state corporation has announced its investment plans in the basic petrochemical industry in advance, enabling private industry to program its investments accordingly. The average of installed idle capacity in these industries turns out to be lower than 20% on the average (that average was affected by the resin plants), but in many cases the size of the plants was not optimal (from the point of view of scale); the differential between national and international prices reached 60% and 78% in some instances. This differential was considerably less in synthetic fibers and fertilizers, probably because the scope of the market in these branches allowed production on more efficient scales. In the case of resins, the market is quite tight and, moreover, since numerous products of this branch are directed to a high revenue market, larger-scale production is not feasible (certain resins for finishes for bags or shoes, varnishes, and others). In many of these cases, diversification of the lines of production has been sought (at times through multiproduct plants). In any case, it does not seem that the market is reduced by tariff levels.

Finally, the tariff levels on equipment for the process industries are not high and have permitted importing, without difficulties, equipment that is not produced locally. The national integration of the equipment used in these industries varies almost with each product. This integration is elevated in the case of resins and of firms that pack fruits and vegetables; in turn, it is lower in fiber, fertilizer, and milk-processing plants. (Furthermore, the development of industrial engineering firms has had considerable repercussions on the origin of the equipment employed: the carrying out of

detail engineering and the offering of services like the purchase and supervision of machinery influence the selection of suppliers.)

In terms of the use of the exemption offered by Rule 14, the great majority of the companies visited had imported machinery under the shelter of this instrument: 52 of the 67 firms (20 in capital goods, 14 in petrochemicals, and 18 in foods). The firms using Rule 14 had a slightly greater percentage of foreign machinery than the total sample, as shown in Table 5.

An interesting aspect is the high participation of transnational firms: 14 in capital goods, 9 in petrochemicals, and 8 in foods used Rule 14, or, that is, more than 60% of all the units that made use of it.

Once again, a question arises about the cost of this type of instrument: if one peso of fiscal sacrifice equals, in effect, a public expense, what is the justification for earmarking resources for financing the purchases of foreign machinery by a transnational corporation? In the past, the importance of the transnational companies as importers of capital goods has been difficult to analyze because of a lack of corporate-level information. In this study, the imports of 33 subsidiaries of transnational corporations in 1972 were analyzed to determine the level of their imports of capital goods (6). These firms operated in five branches of the manufacturing industry, and the share of their imports of capital goods within the total imports in each of these branches is shown in Table 6.

These figures reveal the decisive importance of the subsidiaries of transnational corporations as importers of capital goods. The study done by Fajnzylber and Martínez Tarragó determined that the share of imports of capital goods was 34% of the total amount imported by transnational firms in all branches of the manufacturing industry in 1970: a total of more than 2,800 million pesos in that year.

Many of these imports come from firms affiliated with the same group, and their price can be used to transfer resources abroad by means of overpricing. Without a doubt, Rule 14 was frequently used to bring about these imports (and it is to be expected that in the future similar exemptions will be used for the same purpose).

Levels of idle capacity do not seem to have been affected by the use of Rule 14. The average idle capacity in the firms that used this instrument in each branch was the following:

Capital goods (20 firms)	- 34%
Petrochemicals (14 firms)	- 23%
Foods (18 firms)	- 27%

These levels are not very different from the general levels of the entire sample precisely because almost all the companies used Rule 14 while it was in effect. Clearly, comparison with firms that did not use this exemption is difficult. The general average of idle capacity in each branch was slightly less in the capital goods and petrochemical branches (32% and 20% respectively) and the same in foods. Although it would be difficult to conclude that this instrument was responsible for that difference, there are indeed sufficient indications for thinking that overcapitalization was encouraged in this and other branches of industry (7).

It was also important to single out the fact that among the firms visited that used Rule 14, 19 had made purchases of used machinery. Part of that machinery was brought into the country under the shelter of this instrument, but it was not possible to determine exactly the proportion of secondhand equipment imported in this way for each of the 19 firms. The 19 units are distributed thus: 12 in capital goods, two in petrochemicals, and five in foods. The characteristics of the process for the manufacture of capital goods permit the combination of machinery of different technological ages, so it is not surprising that this branch is the one that reveals the most important purchases of used machinery encountered in the study: 22% of the plant equipment turned out to be secondhand, against 1% in petrochemicals and 6.6% in food companies.

The Implications of the Control of Technology Imports; an Assessment (Venezuela)

Import control policies are the principal instruments of the policy of industrial protection and their orientation responds to the need to safeguard the production of goods made in Venezuela. Thus this policy, with each of the instruments acting in its own way, either impedes or makes difficult the importation of commodities that are produced

locally (natural and synthetic textiles, clothing, knitted fabrics, etc.). At the same time it permits and facilitates the entry of products not produced in the country or whose existence is necessary for the production of certain finished products (oil, crude oil, bituminous minerals, synthetic rubber latex, machinery and equipment, etc.).

According to the logic of the Venezuelan industrialization model, the process of import substitution implies initially the importation of capital goods required for local production of the commodities that were previously imported. It is only later, once a market of reasonable proportions is created and the capital accumulation necessary for the self-sustained development of the sector is attained, that it is possible to begin substituting imports of machinery and equipment. Venezuela is not at this stage, which requires a change in the use of the instruments of foreign trade.

Venezuela's approach to industrial development has meant that a demand for technological knowledge previously implicit in the imported consumer products has become explicit. To better understand this idea, it should be remembered that the model under discussion never questioned the consumption pattern inherited from previous stages of the economic history of the country. This in turn determined the direction and characteristics of the productive system that was recently established.

On the other hand, the Venezuelan state has been able to offer considerable facilities for the importation of technology and capital goods, because the major part of its revenue comes not from customs duties but from the Hydrocarbons Tax and the income tax levied on the oil companies. Thus it is very clear why the instruments of foreign trade have been used in a manner consonant with the demands of the diversification of the productive apparatus that were implied in the first two stages of industrialization by means of import substitution.

But this is only one aspect of the problem. It must also be pointed out that the abundance of foreign currency as a consequence of the oil production has resulted, among other things, in an external overvaluation of the national currency.

This has operated in the background as a mechanism for the transfer of the benefits coming from the oil sector to the rest of the national economy, and has resulted in an internal wage level - when measured in foreign currency - that is far higher than that of other countries where the mean productivity is superior to that of the Venezuelan economy. The practical corollary of this situation is very simple: any national economic activity whose average wage is above the productivity average can only deal with foreign competition by means of a strong protectionist policy.

Moreover, it is more than clear that a strong protectionist policy - when it operates through taxation - tends to raise the prices of nationally produced goods. The Venezuelan industrial process constitutes a good example in this respect.

The implications of all this for the importation of technology and capital goods are evident: while these are not nationally produced, the practical consequence of the external overvaluation of the local currency is that they tend to get increasingly cheaper relative to the cost of local labour and of local finished products. In such circumstances it is understandable that there is a tendency toward overmechanization in all productive sectors and, as a result, toward the importation of machinery and equipment.

Thus, even if it is true that oil production contributed significantly to overcoming the first stages of industrialization in Venezuela with relative ease and in record time, it is also no less true that the pattern of technological behaviour that it induced generates serious obstacles regarding the possibilities of substituting imports of capital goods and, as a result, with respect to the vertical integration of the productive system.

Unlike other Latin American countries where the state has confronted problems in obtaining its resources and in correcting the balance of payments, Venezuela has been in a position to make fairly good use of the customs duties, import licences, and exoneration of import duties to orient the industrial process of the country.

This exceptional situation derived from the oil wealth has not, however, been well taken advantage of. First, it cannot be said that these instruments have implied in practice a truly orientated policy. Venezuelan industrialization began with a pre-existing pattern of demand, which conditioned the subsequent evolution of the national productive apparatus. The latter was orientated from the beginning toward satisfying

the consumption needs of high-income groups, and for this purpose it sacrificed the production of capital goods, which was left until the traditional industries reached a certain level of development. Within this evolutionary logic the instruments of foreign trade fulfilled a wholly consonant function, which consisted of defending the production of finished goods and practically liberalizing the importation of machinery and equipment.

Second, the application of the protectionist policy has not been selective. All it really consists of is a very general policy whose intention is defending national factories and allowing the introduction of foreign investment goods. Protection has been conceded without taking into account the type of goods produced in the country, the size of the industries that produce them, the composition of the capital, their location, etc. At the same time facilities for importing capital goods have been granted without the use of criteria that might improve the structure of the productive apparatus.

Finally, it should be pointed out that the import control policies have been subject to the pressures of diverse interests, which influence in an unfortunate manner the fixing of tariffs and especially the concession of licences and the exoneration and lowering of import duties. This fact further reduces the potential of these instruments as orientators of the Venezuelan industrial process.

On the basis of all that has been said until now, the Venezuelan team pointed at the following repercussions of the import control policy on technological development.

(1) It contributes to making explicit the demand for technology, which was implicit in the goods imported during the so-called outward growth phase.

(2) It contributes to deforming the consumption pattern by liberalizing the importation of goods that are not produced locally. This deformation clearly favours the high-income groups and leaves its mark on the consequent evolution of the productive apparatus.

(3) It contributes to the destimulation of the development of the capital goods industry by liberalizing the imports of these goods. In this way it fulfills the implications of the logic of import substitution. This is especially important given that this industry has a decisive role in technological development.

(4) It contributes to the distortion of factor prices by making capital cheap in relation to labour. This distortion has played a part in the tendency toward the use of capital-intensive technology.

(5) It contributes the overcapacity of industrial establishments and consequently to a high percentage of idle capacity and high production costs, which have turned into high prices and reinforce income concentration.

(6) It contributes to creating an excessively protectionist framework, which tolerates the coexistence of high inefficiency with high profit margins.

THE CONTROL OF FOREIGN INVESTMENT

The second major method of control is that of investment. Like import controls, investment controls are established with multiple policy goals; like import controls too, they have an implicit effect on technology. Investments and imports are similar in that controls have a wide and often unanticipated effect on technology.

A case can be made that investment controls have a more immediate effect on technology than import controls. In a developing country the structure of investment is highly concentrated; the relative importance of large companies is greater than in developed economies. The average firm or establishment, measured by employed labour, is small - so small that its equipment needs are rudimentary and its capitalization minute. Such companies or establishments could not, even if they wished, purchase or use current technology. Effective investment is concentrated in larger firms so that their technology choices, particularly in machinery and equipment, have a disproportionate effect on the technology ruling in a sector.

Where the average firm size is small, in any given sector, then the entrance costs for companies are also small. Because there are a few large firms surrounded by many small ones, major investments have an important impact on the structure of investment. Such an investment, it should be noted, need not be large compared with developed

countries. A relatively small investment, in developed-country terms, can purchase market leadership in smaller economies. Firms that can meet the requirements of larger-than-average investments, and whose frame of reference is the leading companies rather than the industry average, face few entry barriers.

Companies that intend to obtain a national market share must purchase equipment that allows them to reach, perhaps over the medium term, a solid market share. Choice of technology is therefore linked to the size of the investment. The link between technology and investment is clearer where (a) the investment is foreign investment, (b) it is direct, and (c) those foreign companies are well-established in another part of the world. Where direct foreign investment fits the above conditions, then the third can be amplified more precisely. For if the company is established in other countries it is likely to have (d) production and marketing system know-how and (e) a corporate technology policy. In (d) would be included both embodied technology (machinery use, plant layout, etc.) and disembodied technology (production experience, brand names, etc.). The larger a firm and the greater its plant distribution in world terms, then the more likely it is that it will have a corporate technology policy based on its present and past operating experience.

These conditions, particularly (d) and (e), are rarely present in domestic companies. Their production and marketing systems are the result of experience in one country, whereas corporate technology policy is rarely the result of rational choices, but is dependent on their progress in one market. Domestic companies depend on market growth to reach a given size; foreign companies, given the above conditions, can reach a large market share, if not immediately, at least in a much shorter time. Direct foreign investment poses a greater threat, given this concentrated economic structure, than would competing domestic companies.

There are two other points to add to this admittedly crude description. First, the technical leadership of foreign companies is more pronounced in particular sectors, and second, their planning horizons are longer. Foreign companies, being technical pioneers, have particular comparative if not absolute advantages in certain high-technology sectors. Such sectors include chemicals, transport and electrical equipment, electronics, scientific instruments, machine tools, and most capital goods. For nations to develop these industries, they often have to rely on foreign investment. With no foreign investment, there is little or no development. Furthermore, being backed by international experience, they often enter the market with longer planning and investment payback periods.

These remarks have emphasized the economic problems of foreign companies. This was done to show that there is an economic case for raising entrance barriers to such firms. But there is a greater and perhaps more important case, which does not depend on economic reasoning but on questions of national identity and sovereignty. Many of the policies discussed in this section cannot be understood without accepting that nationalism, and particularly economic nationalism, plays a crucial role in the definition of policies to direct foreign investment and multinational companies. The main policy conclusions, given this nationalism, are (a) a feeling that not only private companies but the nation is at a disadvantage from direct foreign investment, (b) that this has a national as well as an economic cost, and (c) that direct foreign investment replaces or excludes domestic investment, leaving domestic groups with fewer investment opportunities.

Many of the STPI countries, therefore, have created entry barriers based on investment criteria. These investment barriers may, for the national good, reserve investment opportunities for the state or domestic investors or require matching or percentage formulas for joint domestic/foreign investment. The ability to create such barriers depends on the coherence of government policy, the current investment structure, and the history and politics behind foreign investment decisions. These features have to be understood when examining the legislation, structure, and performance of the organizations that monitor such legislation.

The first subsection examines relevant legislation in three countries. In Mexico, foreign capital and its influence have been key political issues for over 50 years. There is a sense in which the new Foreign Investment Law is a necessary supplement to the piecemeal decisions taken previously. Because of the importance of direct foreign investment and because it continues to be an attractive country for foreign investment, the Law does not revise past investments but scrutinizes current applications. Legislation in Colombia is more related to fiscal and exchange controls. Here the legislation

has been influenced by Colombia's membership in the Andean Pact and includes technology conditions as well as investment criteria. In Korea, the association between technology and investment is also made, although Korea, unlike some of the other countries considered in this study, encourages private foreign investment.

The second subsection demonstrates the difficulties of finding the appropriate administrative criteria by which to analyze the effects of foreign investment. The description of Mexico shows the complexity of multiple objectives, while that of Venezuela, based on a survey of businesspeople's opinions, shows how difficult it is to find appropriate descriptions for capital and royalty payments. The evaluation of SIEX demonstrates how bureaucratic bodies too often fall back on formulas that are easy to manipulate rather than making effective investigations or inquiries into the real value of foreign investment.

Finally, the last subsection on the electronics industry in India provides information on the present structure of foreign investment in that industry. Policy objectives seem to be the result of a matrix: a column based on the foreign ownership percentage and rows defining their technical and foreign exchange contributions. At the time of this report, the greater the percentage of foreign ownership, the greater the requirement for effective technical and foreign exchange contributions.

The experience of these countries is difficult to summarize. The capacity to evaluate foreign investment will depend on greater experience and a greater collective - that is, between developing countries - understanding of investment decisions. Nonetheless, foreign investment control has provided developing countries with a bargaining instrument that can help clarify the difficult choices that they face.

Legislation

Foreign Investment Law (Mexico)

The most important instrument in Mexico is the Law for the Promotion of National Investment and the Regulation of Foreign Investment (hereafter quoted as the Foreign Investment Law, or LIE) of 1973.

The first article of this Law points out that its aim is the promotion of Mexican investment and the regulation of foreign investment "in order to stimulate a just and equilibrated development, and to consolidate the economic independence of the country." It is evident in this explanation of the objectives of the Law that the intention was clearly to create a regulatory instrument that did not scrutinize the validity or justification of foreign investment per se. The Law simply attempts to renegotiate and to reduce the cost implied in the acceptance of the position of "lesser partner" on the part of foreign capital.

To achieve this objective, an attempt is made to control the amount and orientation of direct foreign investment with the aim of achieving an industrial development based on internal savings to preserve, to the maximum degree possible, the economic and financial independence of the national entrepreneur. The possibility that foreign capital might contribute to this process of industrialization is not discarded, as long as such participation is minority. In this manner, another formal concept of protection is introduced, by which an enterprise with 49% foreign capital will be considered as national. The possibility was never raised of establishing schemes of slow divestment similar to those approved in Decision 24 of the Commission of the Cartagena Agreement (8). Furthermore, to present an idea of the process of negotiation and the pressures exerted during the elaboration of the bill, it is sufficient to remember that when the existence of the preliminary draft was made known for the first time (in the President of the Republic's work session with members of the scientific community, 29 November 1972), that document contained a provision that abolished the existence of bearers' bonds under all circumstances, and made the issuance of registered bonds obligatory without exceptions (9). The meaning of this provision was later changed and it was established that bearers' bonds could continue to be utilized by national investors.

In preceding stipulations, direct foreign investment (DFI) is defined in relation to the individual that carries it out, and LIE adopts this definition: DFI is that which is carried out by foreign legal entities or individual, foreign economic units without legal capacity, and Mexican enterprises in which foreign capital has a majority participation or in which foreigners with immigrant status, residing in Mexico, which is considered as Mexican investment unless it is found to be "linked with foreign economic

decision-making centers" (10). Not only is this last criterion very difficult to handle, but the definition of a foreign legal entity is very deficient. (The definition accepted by LIE is similar to the excessively formal concept of national integration in which inputs of national origin are those that have foreign components of up to 40%.)

The Law later establishes a classification of the sectors of the economy, taking as a criterion the variable proportions in which national and foreign capital may participate. Thus, the following sectors remain under the exclusive control of the state: petroleum and all hydrocarbons; basic petrochemicals (11); the exploitation of radioactive minerals and the generation of nuclear energy; mining; electricity; railroads; telegraphic and radiotelegraphic communications; and any others that specific laws fix. (Actually, this does not add anything new because in other laws and in the Constitution the control of the state over this same group of activities was reserved.) Although historically this situation was arrived at as a result of the desire to recuperate the control over certain natural resources and a few branches of economic activity considered as strategic, presently (and since 1940) the role of the state in these areas has been limited to supporting the demands of the industrialization project of national and foreign capital (subsidizing by means of low prices for private enterprise, maximizing production, etc.) (12).

Moreover, according to LIE the following sectors remain reserved by an exclusion clause exclusively for Mexicans or Mexican societies: radio and television; urban and interurban transportation and federal highways; national air and maritime transportation; forest exploitation; the distribution of natural gas; and those sectors determined by specific laws.

Finally, the intervention of foreign capital is allowed in the following sectors of the economy and in the following specified proportions:

(1) Exploitation and utilization of mineral substances: The concessions may not be issued to foreign societies; DFI may not participate with more than 49% (34% in the case of the exploitation of national mineral reserves).

(2) Secondary petrochemical products: Up to 40%.

(3) Manufacture of components for automotive vehicles: Up to 40%.

(4) Those sectors specified by specific laws: When a specific percentage is not required, DFI may participate with up to 49% of the capital of the enterprises, with the restriction that it may not hold any title to the power to determine the management of the enterprise.

Aspects of Foreign Investment Legislation (Colombia)

(a) Treatment of Foreign Capital (Decree 1239, 1969, and Decree 1900, 1973): By virtue of Decree 1900 of 1973, the government has discretional power to allow or deny foreign investment, looking after the interests of the country. In doing so it takes decisions that affect technology. Before Decree 1900 was issued, the main ruling concerning foreign capital was Decree 1239 of 1969, one of the pioneering policies in this field in Latin America.

Decree 1239 dealt basically with the Royalties Committee, ruling contracts and establishing criteria for decision-making. The criteria concerning the development of technology introduced by the Decree are:

(1) The possibility of manufacturing a product in similar conditions without royalties through the common procedures applicable to this end, and in accordance with modern technology and the national industrial development.

(2) Policies on goods involving new technology.

(3) Policies on the employment of human resources.

(4) Investment relationship between the supplier, subsidiaries or affiliates, and the recipient.

At the same time, the Decree established that the Royalties Committee in making specific decisions should take into account that the different aspects affecting the development of technology in Colombia be taken in consideration when examining technology contracts.

Moreover, it established that the contracts on importation of technology should

contain clauses regarding:

(1) Identification of the characteristics involved in the transfer of technology.

(2) Assessment of the contractual value of each of the elements involved in the transfer.

(3) Definition of life term and form of payment.

Finally, the Decree entrusted the Royalties Committee with the task of identifying systematically the technologies available in the international market, to be able to choose the most suitable. In conclusion, as of that year the issue of the technology involved in royalties, transfers, and exchange began to acquire importance.

Decree 1900 of 1973 enforced Decision 24 in Colombia, establishing a new context for foreign investment. It established a previous control for new foreign investment, and it forced those in existence to become mixed investments (i.e., foreign and locally owned). On the other hand, it restricted priority areas for national investments (insurance, banking, and other financing institutions, among others) and established that new foreign investment would not be allowed into enterprises dealing with national transportation, publicity, communication, or marketing of any product.

Simultaneously, as regards social property, it established norms similar to those of Decree 1234 of 1974 and created a subregional office of industrial property as a linking instrument that may propose new actions and supervise the fulfillment of legal rulings.

With these decrees a position of defence of national interests was initiated in Colombia as regards industrial property, technology, and foreign investments. Through these legislations an initial interest toward a policy for technological development was expressed, whose results after application are still to be seen, but which in any event means a favourable field for the demand, acquisition, importation, adaptation, and diffusion of the most appropriate technologies for stimulating the development of the country.

(b) Division of Private Investments: The Division of Private Investments (within the National Planning Agency) is an institution of the central government to which all projects are submitted for approval where foreign capital is involved. It aims at the achievement of a balance-of-payments equilibrium and an adequate use of the financial, human, and technological resources of the country.

This Division of the National Planning Agency has contributed to a certain extent to the improvement of the bargaining power of national users of technology. The achievements of this Division have clearly shown that the negotiation capacity depends to a large extent on the knowledge of the technology to be used in a given project.

(c) Exchange Office of the Central Bank (Decree 444/67): The functions of the Exchange Office of the Central Bank are more those of an office for registering transactions to comply with the law or to obtain benefits than an organism with discretional powers to enforce certain behaviour on technology.

The structure of this office was established by Decree 444/67. Since all foreign exchange is under control, this Office is empowered to register transactions such as foreign investment, reinvestment, profit remittance, etc. But the approval of new foreign investment is granted by the National Planning Department. Contracts for royalties are registered in the Office, but the approval is granted by the Royalties Committee, and so forth. For other contracts (artistic, professional, leasing of equipment, etc.) it can study them and approve or object to them completely or in part.

The Exchange Office therefore keeps a complete record of every transaction involving foreign exchange, but for the most important decisions regarding technology it must abide by the dispositions of other government organisms. Only for very few of them can it take more effective action, but mostly for secondary issues.

Foreign Investment Legislation (Korea)

(a) Foreign Capital Inducement Law: The Foreign Capital Inducement Law is the most important policy instrument governing both foreign capital investment and the commercial importation of foreign technology. This Law regulates investment by foreigners,

foreign loans, and technology imports. It also regulates directly all technology transfer contracts. A technology transfer contract is defined as a contract for the purchase of industrial rights and the right to use techniques associated with broader technological collaboration or investment.

The Law stipulates the criteria for screening the technology to be imported, setting priorities and procedures for its importation. The Economic Planning Board is given the primary responsibility in administering this Law, which also established a cabinet-level committee, the Foreign Capital Inducement Deliberation Committee. The various financial and administrative benefits given to the supplier (and the recipient) of desirable foreign techniques are also based on the Foreign Capital Inducement Law. Tax holidays, tax reduction, protection of properties, guarantee of profit remittance, and special treatment in export and import are stipulated in this Law.

(b) Foreign Exchange Control Law: The main purpose of the Foreign Exchange Control Law is to control foreign exchange transactions to maintain a balance of payments and to achieve the stabilization of the internal monetary market. The importation of foreign technology, which is not regulated by the Foreign Capital Inducement Law, comes under the jurisdiction of this Law. For example, the payment for services rendered by foreign nationals or the payment for technical information is regulated by the Foreign Exchange Control Law. Compared with the explicit provisions stipulated in the Foreign Capital Inducement Law with respect to the technology inducement contract, the Foreign Exchange Control Law vaguely gives the control authority to the Minister of Finance.

Structure and Function of the Legislation

National Foreign Investments Commission (Mexico)

The organism in charge of applying the Foreign Investment Law is the National Foreign Investments Commission (CNIE), made up of seven heads of the most important Ministries and aided by an Executive Minister. The Commission has the following powers:

(1) To determine increases or decreases in the percentages stipulated in the last paragraph of the fifth article of the Law.

(2) To determine the percentages and conditions by which foreign investment will be accepted in those cases that merit special consideration.

(3) To determine which purpose DFI should be allowed in established enterprises and in those that are to be established in Mexico, or in new establishments.

(4) To determine the amount of DFI existing in Mexico in new fields of economic activity or in new lines of products.

(5) To be the obligatory consultative organ in matters of foreign investment for dependencies of the Federal Executive and the state enterprise sector, as well as for the National Stocks and Bonds Commission.

(6) To establish criteria for the application of the Law and regulations concerning DFI. Also, authorization is required from the Commission in cases in which foreign capital acquires more than 25% of the capital of an enterprise, or more than 49% of the fixed assets of an enterprise.

And finally, the Commission will be able to grant the right of preference to Mexican investors to accomplish the acquisitions referred to in the preceding paragraph. The same Commission should promote the acquisition by Mexicans of capital or of fixed assets placed in the country (13).

The National Registry of Foreign Investments (RIE) was also established, in which all foreign persons, societies, or enterprises with investments in Mexico must register themselves (14).

The Registry permits the Minister and the Commission to rely upon the most complete information bank concerning this topic, but its functions are essentially different from those of the Registry of the Transfer of Technology (RNTT). In fact, whereas the registration of a technology contract in RNTT implies a negotiation with the parties involved and an intervention of the instrument in the formal conditions of the transfer of technology, in the case of RIE the registration of an act does not necessarily imply negotiation with, or intervention by, CNIE. Although the Executive Minister bases his studies and decisions on information from the Registry, the activity of the Registry is

closer to that of census or informative functions. An enterprise with 49% foreign capital in the capital goods branch (or in whatever branch that is not subject to specific regulations) should register itself in RIE; however, such a registration may not be necessary because the provisions of the Law are fulfilled. The National Commission of Foreign Investments has limited its discretionary powers to the examination of increases or decreases in the 49% unit and to fix the conditions by which foreign investment will be received "in specific cases" (V Art., LIE).

In any case, to issue its resolutions, the Commission should take into consideration a series of criteria that the same Foreign Investment Law (Art. 13) defines. These criteria may be classified in the following five groups:

(a) General Policy Directives Concerning DFI: For example, DFI should be complementary to national investment, it should not replace it; DFI should preserve the sociocultural values of the country; the degree of identification of the foreign investors with the interests of the country and their ties with foreign economic decision-making centres will be taken into consideration; in general, DFI should contribute to the accomplishment of the objectives of national development.

(b) Criteria Concerning the Conditions of Production: For example, the impact of DFI on employment generation is considered; DFI should not occupy monopolistic positions in the national market; its effects on the price level and the quality of production are also considered.

(c) Criteria Concerning the Foreign Sector: For example, the positive effects on the balance of payments and especially upon the increase in exports will be considered; also, the means by which the operations are financed with foreign resources.

(d) Criteria Concerning the Development of Technology and Human Resources: The technological contribution and the contribution to research and development of technology in the country is considered; so is the training of technicians and administrative personnel of Mexican nationality.

(e) Criteria Concerning the Integration of the Industry: Because of its importance since it is the preferred objective in several mechanisms of Mexican industrial policy, a special section about the criteria concerning the incorporation of national inputs and components in the elaboration of products is included.

It is evident that some of these criteria are very difficult to handle. The criteria of "impact on employment, positive effects on the balance of payments, and the technological contribution," as well as other instruments of industrial policy, cannot have an important content without a definition of the industrial policy and a determination of the role that should correspond to foreign capital. Any project of foreign investment is going to generate employment: How can the "impact" be evaluated without comparing the project with alternatives? Moreover, the "contribution" will be the most modern or the most efficient technology. But could one really consider the technology to produce peach-flavoured yogurt aimed at the consumption of high-income groups as a technological contribution? And as far as the effects on the balance of payments are concerned, how will they be evaluated if there are no limits to the repatriation of profits by DFI?

Evaluation of the Application of Decision 24 (Venezuela)

A recent study carried out by Moises Naim concerning Venezuelan policies on foreign investments and technology transfer includes a preliminary evaluation of the effects of the application of Decision 24 in Venezuela, based on the analysis of 23 interviews with firms established in the country. In spite of its scarce empirical support, this paper gives quite a good description of the application of the norm and of its limitations.

The study assumes that the ultimate purpose of Decision 24 - and thus of its Venezuelan implementation and of SIEX - is to reduce the extent of foreign dependence of the national economy. This is to be achieved through:

(1) The prohibition of foreign investments in certain areas of the economy.
(2) The control of the activities of foreign firms.
(3) The strengthening of the bargaining power of national firms.
(4) The reduction of technology import payments.

(5) The evaluation of the new foreign investments, based on their economic contributions to the country's development.
(6) The Venezuelanization of foreign firms.

In relation to these objectives the conclusions of Naim's report are the following:

(1) While in some areas the prohibition of foreign investments is being enforced (iron, petrochemicals, banking and insurance, minerals and petroleum, publicity agencies, mass media, and telecommunications), in the local distribution of goods and services foreign firms continue to operate and nothing leads one to think that in the more or less immediate future substantial changes will occur in the property structure of this sector.

Before becoming too optimistic about this first conclusion of Naim's report, it is worth making two important comments. First, one must recognize that the Venezuelanization of the economy is not achieved merely by preventing foreign capital from owning more than 40% of the shares of a locally established firm. To believe that this is possible implies not recognizing that, apart from capital property, other factors are at work that can secure for the foreign investors the control of the firms in which they participate, such as management and technology. On the other hand, it should not be forgotten that Decree 2031 introduced some changes in the previous national legislation and such changes have as their proclaimed aim to "increase the flexibility of the treatment given to foreign capital." In this fashion, and by virtue of such a decree, the opportunities for foreign investments in the field of internal commercialization of commodities, consulting, and engineering have considerably widened.

(2) Concerning the control of foreign firms, attention should be paid to their transfer of funds abroad. The Venezuelan legislation prohibits any transfer above 14% of registered capital and royalty payments between the subsidiary and the parent firm. Concerning the second disposition, it was possible to establish that the legal control is ineffective because royalty payments could be hidden under other items (such as, for instance, technical assistance services).

(3) Concerning the effects of Decision 24 as to the strengthening of the national businesspeople's bargaining power, Naim did not find satisfactory evidence. By means of his interviewing, he established solely that the increase in bargaining power originating from such norms was counterbalanced by other factors that were not within the scope of the measures taken.

(4) It is not an easy matter to estimate the amount of savings that the country has made due to the intervention of SIEX. It is true, nevertheless, that payments for technology will be reduced more significantly in the future as SIEX gains in experience, but only in terms of explicit payments. The implicit costs of technology transfer (which were probably twice as high as the explicit ones in 1976) will remain free from any control until fundamental changes are introduced into the present legislation and, particularly, until effective control mechanisms are put into practice.

(5) Even though most of the businesspeople Naim interviewed thought that the foreign investment flow had declined because of the policies adopted, Naim does not postulate any conclusion about this. Probably it would be necessary to wait for a longer period so as to weigh the effects of the policies in this respect.

(6) It was not possible for Naim to reach firm conclusions concerning divestment of foreign capital. Also in this case it may be convenient to wait longer before making judgments.

Evaluation of SIEX: Bearing in mind the two limitations (the fact that the code and its application are only a recent experience and the lack of sufficient information), it is possible to continue and complete the previous evaluation, but this time centering it on SIEX and circumscribing it to the question of technology transfer, which is of prime concern in this report. The following comments should be made concerning the management ability of SIEX:

(1) SIEX is in the position to provide only a formal-juridical evaluation of technology transfer contracts because of four limitations. First, the information it receives is too limited and prevents it going any further. The data gathered with the questionnaires that firms must fill in do not reveal the heart of the operation that is supposed to be registered, in spite of the fact that the norms demand a detailed description of the object of the contract. The opinion of SIEX is based on that information;

thus the most important aspects of the contracts cannot be referred to. Second, the personnel SIEX works with is insufficient both quantitatively and qualitatively. In its boom period, 1975 to 1976, SIEX had only the following employees to evaluate 10 new contracts per month, not to mention the 1,094 old contracts that had to be revised: one economist, one economics student, two engineers, and three lawyers. The weakness of this team has been accentuated by a number of resignations, which has had negative effects on the integration of a working group and the accumulation of experience in the area. This fact surely explains the postponements of the deadlines for the contracts signed before the first of January 1974 so they could be adjusted to the dispositions established by the new norms. Third, SIEX does not have the information system that could cover all the aspects related to the transfer of technology. This absence is understandable due to its short existence. It is enough to say that without sufficient and opportune information about available technological alternatives (possible suppliers, different conditions for supply, etc.), it is impossible to make an adequate evaluation. It would not be possible to take into consideration the economic, juridical, and technical factors that are involved in the technology-import process. Fourth, SIEX has yet to take its first steps toward a technical evaluation of contracts. Furthermore, SIEX has not managed to establish permanent links with R&D institutions, engineering firms, etc., that is, with the organizations whose opinions are indispensable for judging the value of a given technology. In other countries, the institutions in charge of the control of technology imports have built supporting networks to help them to make a thorough and rapid evaluation of the contracts that are submitted for approval.

(2) From an institutional point of view, SIEX has undergone two changes that undoubtedly affect its performance. One of them is the loss of the oil and petrochemical sectors, which are not under its jurisdiction anymore. In effect, according to a recent decision (October 1976) of the National Executive, everything concerning foreign investments and technology transfer in those sectors is directly under the control of the Ministry of Mining and Hydrocarbons. We are not in a position to go further into the motivations for this decision, but we think it must be due to the attempt to give special treatment to these sectors, in view of their position within the national development strategy. This supposition would be confirmed if a new separate bureau is also created for steel. It is worth pointing out that behind this decision rests the idea that in the basic sectors technological policies must be subordinated to economic development policies, because they are in a sense alternative policies that oppose one another. For this reason, special treatment is given, less rigorous in technological terms and more secure in economic terms.

The second significant change is the new institutional location of SIEX, which was dependent on the Ministry of Development and which was recently transferred to the Ministry of Finance. We believe that with such changes SIEX weakens its links with the most important institutions of the country concerned with industrial policy located in the Ministry of Development. This situation risks isolating the control of technology transfer and may reduce that control to a mere register of contracts.

Besides these aspects, which concern mostly the institutional function of SIEX, it should not be forgotten that SIEX works in a context of technological dependence and that it could at best only help to diminish, but not eliminate, the negative consequences of this dependence. Even if it may seem obvious, it is worth remembering that the technological dependence of the country does not consist only, or even primarily, of the conditions for technology importation - where SIEX could have an effect - but of the global development pattern that has been adopted.

Foreign Investment Policy in One Sector: Electronics (India)

It is possible to group the foreign companies operating in the electronics area in India into four broad categories:

(1) Those that are wholly owned by foreign companies or are subsidiary to them: the outstanding example in this category is IBM, whose Indian operations are controlled as a branch of the IBM World Trade Corporation with its headquarters in New York; similar is the case with ICL (Marketing) Ltd. A few other companies such as ASEA and ERICSSON are also in the same category, but these are comparatively small and operate in specialized fields.

(2) Companies in which the foreign companies have a majority equity participation: In this category are companies such as Siemens, Philips, English Electric, Gramophone Company, and International Computers (India) Manufacturers Ltd., in which the foreign

equity percentage is around 60%. All these companies have played a significant role in one or another aspect of the electronics industry. For instance, Siemens has been prominent in the field of control equipment; Philips in consumer electronics and components; English Electric in instrumentation; Gramophone Company in the production of gramophone records, and International Computers (India) in the manufacture of computers and peripherals.

(3) Companies in which the foreign equity content is substantial but not in a majority (i.e., below 50%): These are companies such as Bush India and Murphy India in both of which Rank-Xerox have a participation of 40% and less, and newer companies such as O/E/N with a participation of 45%.

(4) Companies in which the foreign equity content is comparatively small (i.e., less than 30%).

The Electronics Commission has been critically examining in the past few years the role of the foreign companies in the growth of the electronics industry in the next few years. It has laid down two primary criteria in this regard: (a) obtaining significant technological gains through the operations of these companies that are otherwise not easily obtainable, or if obtainable, only at a much higher cost, and (b) earning significant foreign exchange through export by these companies. The Commission has felt it necessary to safeguard any possibility of such companies getting a foothold in areas normally barred to them. Where a particular item is reserved in the small-scale sector, there is an automatic imposition of export obligation of 75%. But even in cases where the item is not specifically reserved in the small-scale sector, substantial export obligations are being imposed on companies with high foreign equity to counteract the outflow of foreign exchange through dividends and royalties. It is also being ensured that since the exports are for a limited period of 5-10 years, the possible later adverse impact on the Indian domestic market should be counteracted and a potentially high-growth local market protected for the indigenous industry.

It is on the basis of these considerations that the Electronics Commission had taken major policy decisions in the last few years, in regard to the further growth of foreign companies in areas that are considered soft from the technological point of view, or that offer substantial scope for local entrepreneurs, particularly those who are technically oriented. In the television receiver industry, it was therefore decided that companies with substantial foreign equity such as Philips, Murphy, or Bush need not be given licences in view of the fact that their brand names are likely to inhibit any growth of the industry on purely indigenous lines. Again, in the field of electronic desk calculators, licences both in the organized and in the small-scale sector have been given primarily to indigenous companies and entrepreneurs. In both these areas, there has been a significant growth of local entrepreneurship in the last 2 years because of the fact that these areas have been virtually demarcated for indigenous industry rather than those in which foreign technology and brand names are likely to play an important part.

The Electronics Commission has also given careful thought to the possible future avenues of growth in regard to the foreign companies. It has considered that while on the one hand there is the need to protect the indigenous industry from the adverse impact of the working of these companies, it should also be ensured that companies that have access to the latest technology as well as marketing channels should be enabled to play their part in the growth of the electronics industry in the country. This is particularly so in regard to export earning, where the companies producing items with internationally known brand names can find wide export markets all over the world. One has, therefore, to balance the outflow of foreign exchange due to dividends and royalties as well as the inhibiting impact of the foreign companies on the indigenous industry with the advantages of having access to new technology as well as to wide export markets.

The Electronics Commission had taken up the role of IBM in the computer area in a series of discussions with the company. Based on these discussions, the Commission decided that IBM, which controls 60% of the total world market and 74% of the Indian market, cannot be allowed to continue on the basis of importing used machines and refurnishing them without at the same time being willing to dilute its foreign equity according to the guidelines laid down by the Government of India. It was therefore decided in 1971 that the manufacture of the AS-IS machines had to be phased out and this is now being implemented.

On the other hand, it was felt that a company like IBM should take up the production of items on a 100% export basis. It is now manufacturing key punches (No. 129),

which are bringing significant export earnings to the country. Thus in 1972-73, the export of such punches as well as unit record equipment was in the order of Rs182.56 lakhs, and 1973-74 exports amounted to Rs322.42 lakhs. It is expected that for some of these products, IBM will act as one of the key sources for export throughout the world.

In regard to the second category of companies, the Commission has been laying down specific policies after careful examination of the areas of strength of each of the companies. Thus in regard to Philips, a negotiating team was appointed in 1972 in which the Ministry of Industrial Development was also represented. Philips (India) was required to submit its program of future activities and these were then discussed with the company. Based on these discussions, the negotiating team submitted a report to the Department of Electronics in June 1973, which was subsequently considered by the Electronics Commission. As a result of these discussions, all the pending applications that the company had made in the last 3 years were processed and letters of intent were recommended in specific cases. Further, in accordance with the recommendations made by the negotiating team, the Department of Electronics has taken the view that the company may be allowed substantial expansion or entry into the fields of professional components and equipment, for which there is likely to be a significant demand in the Fifth Plan period, as well as areas where substantial exports are possible. 100% export proposals for variable gang condensers, amplifiers, and intercommunication equipment have recently been cleared by the Cabinet Committee on the recommendation of the Licencing Committee. There will also be a substantial increase in the earnings of foreign exchange through exports of products made by Philips (India) to other countries where the principals of the company operate.

A similar exercise is also being attempted in regard to other companies in this category. Siemens, English Electric, and ICL are being advised to map out specific programs for producing equipment that is either technologically sophisticated or that can be exported in considerable numbers. It is felt that as a result of this exercise these companies will play an important role in meeting the indigenous demand for items currently imported and also for undertaking exports of such items.

In the third category are all companies where the foreign equity content is substantial but not a majority either numerically or in terms of the Foreign Exchange Regulations Act. Thus, Bush India has 40% equity and Murphy India 38% equity content. Both these companies have had a substantial share of the radio market for many years but are now being advised to shift their intention to either technologically sophisticated products or products for significant exports. Bush India has been given approval for the manufacture of pocket calculators and car radios with an export obligation as high as 90%. Murphy is also planning to manufacture items that are either meant for exports or that are technologically more complex. Both these companies have developed, over the years, considerable expertise in marketing and management, and the Department expects that this expertise will be utilized in tapping markets abroad, particularly in Western Europe and the United States.

In the last category are companies whose foreign equity is currently below 30%. The Department has consistently taken the stand that where indigenous know-how is available, it is not necessary for parties to obtain foreign collaboration except where such collaboration becomes useful either for introducing new technology or for undertaking substantial exports. Even in cases where collaboration is considered desirable, the Department, in accordance with the policy of the government, consistently advises parties to make payments for technical know-how, fees, and royalties according to approved norms rather than encourage investments by foreign collaborators. Where such investment, however, becomes absolutely necessary, this is being kept at as low a level as possible.

The electronics industry in India today is on the point of take-off and has a potentiality for high growth in the next few years. It is, therefore, necessary to examine critically the activities of all foreign companies in the field of electronics to determine the role that the government would like them to play in the development of the electronics industry in the country. The Department is also exercising vigilance so that foreign majority companies do not distort the structure of capital investment by Indian companies through purchase of shares or by diversification into areas of trading or commercial activities that are likely to have an adverse impact on the growth of indigenous industry. For this purpose, the Department keeps in close touch with the Reserve Bank of India with a view to ensuring that the powers conferred on the Reserve Bank through the Foreign Exchange Regulations Act are utilized in a meaningful way. Broadly, the Department has taken the view that foreign companies may be allowed to continue operations (or even expand them) for the benefit of the country as a whole; but

they cannot, and must not, be allowed to inhibit the growth of indigenous industry, particularly in the small and medium sector.

REGISTRIES OF LICENCING AGREEMENTS

Between imports and investment lies a grey area concerned with disembodied technology. This area includes technical knowledge that cannot be contained in machinery and equipment but is part of the production and marketing system. Such knowledge is the key to technical development, for it is the accumulated experience of improving, testing, and learning about manufactured products. Nor is such technology limited to the production of goods; marketing and distribution have their own secrets, which are often more difficult to comprehend from outside a particular company.

Disembodied technology, which includes know-how, brand names, corporate techniques, engineering, and design data, constitutes the soul rather than the body of a company. Machinery and equipment can often be purchased on the open market and arranged like any skeleton to represent a body. But the technique of using the body well depends on the mind behind it. Disembodied technology is therefore a collective mind, which, like minds elsewhere, can make the body work skillfully or clumsily.

Given the nature of disembodied technology in the scheme of the firm, it is probably not too surprising that registries concerned with disembodied technology were opposed by both domestic and foreign private companies. Many considered that the state had no right to raise such questions and that bargaining was best left to private companies who knew their own mind. In almost all the countries found in the STPI study, the creation and development of licencing registries has been fraught with political battles.

The demonstration that technology acquisition raises difficult problems has been one of the most important achievements of these registries. The description of India illustrates what some of these problems are. Once it could be shown that a gap existed between private and social costs and that the state had the right to examine technology in terms of the long-term social costs, the next issue was the search for appropriate criteria.

There have been three criteria examined by the registries. The first is the cost of technology. Many of the STPI countries had and continue to have balance-of-payments problems. The attempt to find some flexibility in the foreign account that would save currency is an attractive argument for many governments. Work on registries has confirmed that developing countries are often subject to overpricing of technology products. Second, most of the registries have insisted on the unpackaging of technology. Applicants for technology agreements are required to demonstrate the value of all parts rather than the sum of the acquisition. The process of unpackaging has contributed to a greater understanding of technology as well as to the price of imported technology. Third, registries have tried to take into account the rationality of a given acquisition. Rationality is defined in terms of its domestic effect on the allocation of resources. This criterion is the most difficult to apply, for it requires an understanding of the long-term development goals of the nation. The description of Korea shows concern for domestic research capacity if technology continues to be imported.

The difficulty of establishing appropriate legislation for these criteria is discussed in the second subsection. Legislation has normally set minimum contract conditions for the transfer of technology. Once these are established, as in the case of Colombia, then registry officials must elaborate consistent rules for their application during negotiations. These internal rules are as important as the legislation, for they represent the negotiating boundaries for transfer discussions.

The effectiveness of the registry or organisms that perform a registry function depends on three conditions. First, the registry must receive the support of other government bodies. If a registry is marginal to the government's decision-making process, then it cannot function as a technology net. The lack of bureaucratic cohesion in many of the STPI countries has made their task more difficult because, as the description of Argentina shows, government offices and state companies view the role of the registry no differently from private companies. The registry is perceived at best as a necessary step, at worst as a nuisance. Second, the personnel should be capable of understanding the transfer process and the role of foreign technology within their nation's technology

structure. Too often, as the assessment of Colombia shows, government personnel know little about their own country and thus its needs. Finally, a registry must obtain the confidence of the business community. They must show, as in the case of Mexico, that it is not in the interest of the governments but of private industries to submit contracts to the registry.

The majority of the registries have been working for less than 5 years. Their decisions remain passive rather than active, made after rather than before the discussion of technology transfer. Although this may not change, the registries have begun to generate valuable knowledge about the distribution and use of disembodied technology.

Policy Issues and Objectives

Problems of Foreign Collaboration (India)

In the period from 1947 to 1969 India entered into 2,792 foreign collaborations, i.e., an average rate of one collaboration every 2 to 3 days. Although figures on the outflow of foreign exchange through dividends, repatriation, royalties, technical fees, etc., were not available, an estimate has been made that these amounted to the order of Rs300-400 million per year. Besides the outflow of foreign currency, the prevalence of foreign collaboration has indirect effects on the growth of indigenous science and technology, as well as on the hidden cost of the import of equipment and material from abroad that could have been made available from indigenous sources. The bases for this were (a) a study commissioned by the Planning Commission in 1970, (b) an independent study done by a professor, (c) a case study done in industry, and (d) a study of data done by the NCST Committee.

Some of the major issues that indicated the need for policy changes were the following:

(a) Royalties Payments: The fact that the government has never legislated criteria for collaboration has meant that every such proposal must be submitted to it for approval. The procedure is that of scrutiny and judgment; the government officials do not negotiate with applicants across the table. The government effort in this is to reduce royalties payments, and these efforts would seem to indicate that the government acts on the assumption that either Indian importers of technology are ignorant or they are willing to pay too much for it owing to high profits because of sheltered markets.

The government does not have any data to fix fair royalties, and in the absence of data, conventions have grown up mainly around the rate of royalties on sales. In brief, royalties up to 3% are admissible and might go up to 5% in exceptional cases. The crucial point about these conventions is that the maxima are fixed by product and not by technology. Another result of this is that more advanced techniques that earn over 5% in different areas of the world or that entail higher royalties owing to India's small market are kept out of the country. Another result is that payments are made through means other than royalties, for instance by means of fixed sums. The effects of the government procedures are that advanced technologies are not introduced into India, and that even the obsolete technologies that are introduced end up being paid 5%.

(b) Choice of Collaborator: It was revealed that in 33% of the cases India's businesspeople had considered no alternatives whatever for their foreign collaboration venture, and that 33% had obtained their collaboration by the internationally reputed foreign associates without any shopping around.

(c) Continued Interest of Foreign Collaborator in Technology Transfer: The majority of the foreign collaborators seem either to be totally uninterested or to restrict their association to problem solving. Therefore no steps were taken toward the adaptation and absorption of the imported technology.

(d) The Age of the Supplied Technology: In most cases it was accepted by the Indian party that foreign collaborators rarely part with their latest designs, even under licence. The general opinion was that in spite of foreign collaboration, the Indian party would be always a good 15 years behind.

(e) Role of Foreign Collaborator as Supplier of Equipment, Raw Materials, and Components: In a number of cases redundant or unusable machinery had been purchased

primarily because it was available with tied aid. In one case, besides equipment purchased from a collaborator, almost all the equipment components came from the same collaborator. Many felt that these components were overpriced and that foreign collaborators often exploited their monopoly situation.

(f) Nature and Expertise of Foreign Technicians: It was generally agreed that the best foreign technicians are rarely sent out, and that even if the best are sent, the foreign expert is really specialized in a limited sphere.

(g) Multiple Import of Technology: Over a 10-year period, a large number of multiple collaborations took place; for example: 18 for transformers, 23 for cranes, 12 for gramaphone records, and in nonessential goods: eight for dry batteries, six for ball-point pens.

(h) Emphasis on Consumer Goods: On the basis of the study of 457 technical collaboration agreements over the years 1969-1971, it was noticed that a very small proportion of such agreements were for the manufacture of capital machinery, whereas end-point goods constituted 33% of the collaboration and intermediate products, 39%.

(i) Indigenous Technology Utilization: Offtake from CSIR (Council for Scientific and Industrial Research) to industry has been small: in 1967-1968, the value of output of processes leased out was Rs50 million (about $6.6 million) against a gross output of industry of Rs75 billion (about $10 billion), i.e., less than (0.7%). CSIR earned only Rs1 million, whereas expenditure was Rs187 million. This seems to have occurred because (a) the know-how developed was obsolete, (b) there was no manufacturing experience, and so no follow-up help was available, and (c) there was no cost-consciousness in setting up production.

(j) Administrative Delays: Another problem in the system was that it took an average of 1 year and 9 months for the government to approve collaboration proposals. In over half of the cases the government took over 1 year, and in one case, over 5 years. These delays refer to approved proposals, for in many cases the effect of the delay is to drive away the supplier of technology. One such case was regarding a proposal for the manufacture of vital pieces of textile machinery whose technology is controlled by four or five firms in the world.

Regulating Technology Transfers (Korea)

The transfer of foreign technology to Korea has been characterized by the overwhelming desire to induce foreign investment and increase exports. The desire for economic development overshadowed the technological scrutiny of individual techniques. The most obvious hypothesis in connection with the transfer of foreign technology is a negative one, i.e., the activities of the transfer of foreign technology are secondary to the overall immediate economic considerations associated with the induced foreign capital. This hypothesis is supported by several observations of previous imported technology such as the predominance of indirect mechanisms and many duplications of imported techniques. However, this hypothesis should be qualified with the existing concern for the potential technological impacts of the imported technology and with some strong efforts for technological independence. Whereas most developing countries devote insufficient resources and policy priorities to R&D programs focused directly on industrial needs, Korea had been building up a science and technology base even before the promulgation of the Foreign Capital Inducement Law. Technology is considered as the most important factor for increasing the efficiency of the Korean economy in the coming decade. Therefore it will be increasingly evident that the technological consideration will receive as much attention as the other economic factors in the future. At the worst, the supplier of weak technology must compensate by offering a clear-cut advantageous economic arrangement to receive government approval for the transaction.

In spite of the recent decreasing trend, the demand for foreign technology has been reflecting the lack of confidence in the domestic R&D capability. Even simple techniques, which are fully within the domestic R&D and engineering capabilities, are purchased directly and indirectly to enhance the public acceptance of the final products. This trend was unavoidable in the early industrialization stage and was gradually leveled by the increasing R&D activities in Korea and, most importantly, by the increasing confidence in manufactured goods exported by Korean firms. In connection with this hypothesis, the accelerated development of the science and technology base should be continued

and utilized more effectively for the industry. Although cheap labour and tax incentives have been used to influence foreign investors in the past, they will become less and less important in the future.

In choosing the foreign technology for importation, the assessment was done primarily by the economic planners and profit-oriented businesspeople. Even in the governmental process, the involvement of science and technology officials has been indirect and secondary. Furthermore, domestic scientists and engineers played minimal roles in assessing the proposed technology. With the broadening of the technological base and the increasing competence of the local technologies, this situation warrants a radical revision. One potential system worth examination is a referee system through selected professional societies. The selected professional society should keep a list of specialists (not generalists who have little background in evaluating practical utilities of techniques), who could render professional and impartial judgment on the appropriateness of the technology to be imported. Also it is not evident that the current setup of the Ministry of Science and Technology (MOST) is the best format to make technological inputs in screening the imported technology. While decisions are made by RPB and other operational ministries, MOST's function is more advisory than action-oriented. Being an independent ministry, however, MOST's advisory activities are one step removed from the scene of action. Horizontal linkages between working-level officials are sometimes adversely affected by the bureaucratic procedures.

The present efforts in disseminating imported technology to other domestic users are not enough to maximize the usefulness of the imported technology. The primary factor in this situation is the lack of economic incentives for the recipient of imported technology. In this regard, the role of government laboratories and trade organizations is important and should be reoriented toward small- and medium-scale manufacturers. Small-scale manufacturers cannot afford to purchase technology from the overseas vendors and they rarely have access to technology sources. Training programs, conferences, and seminars on practical topics and engineering information services should be arranged by public or semipublic institutions. The success of Japanese industrial development is credited to the enlightened training of Japanese management, who took the major responsibility for understanding the manufacturing processes and its associated improvement techniques. Information dissemination between businesspeople and technologists is an important facet of improved utilization of imported technology.

Registry Functions; Criteria

Royalties Committee and Exchange Office (Colombia)

In general terms the Royalties Committee must approve, and then the Exchange Office registers, all contracts payable in foreign currency related to technical, scientific, or artistic services, to the expatriation of royalty and commission payments, and to the use of brand names, patents, and the like. The Royalties Committee is made up of representatives from the Ministry of Economic Development, the Department of Planning, the Superintendent of Foreign Trade, the Director of Exchange Control, and the Head of the Exchange Office.

The Committee has set the following criteria for the approval or denial of contracts:

(1) The contract's usefulness for economic and social development, and its terms for the disbursement of foreign currency.

(2) The possibilities of obtaining the end product in similar conditions, without the payment of royalties, through the use of ordinary procedures, resorting to the advances of modern technology and the given development of national industry.

(3) Public agreements made by Colombia, and international practices prevailing in these fields.

(4) The effect on the balance of payments of the country.

(5) The extension of the fabricated products' potential market.

(6) The validity of the product.

It is also established that the royalties obtained in foreign currency by official or private individuals in a legal capacity are to be sold to the Bank of the Republic at capital market rate.

Other aspects that the Royalties Committee analyzes in the contracts submitted for its approval are related to the estimation of the probable profits, to the price of the goods incorporated through the new technology, to the existing policies for the use of human resources, to the conceding enterprise's capital coordination, to the branches of the firm giving the concession, and to possible clauses restricting trade.

The following clauses restrictive to commerce, which impede the approval of a contract, are worth mentioning:

(1) Clauses in which the furnishing of technology implies the obligation for the receiving country or firm to acquire from some source capital goods, intermediate products, raw materials, or other technologies, or to use permanently the staff indicated by the organization providing the technology. In exceptional cases the Committee could accept clauses of this nature to secure capital goods, intermediate products, or raw materials, but only when the prices implied prove equivalent to the ones established in the international market.

(2) Clauses according to which the firm selling the technology reserves the right to set the sale or resale price of the products manufactured through its licence.

(3) Clauses that contain restrictions concerning the volume and structure of the production.

(4) Clauses that prohibit the use of competitive technologies.

(5) Clauses that establish a total or partial option on buying in favour of the provider of the technology.

(6) Clauses that demand the payment of royalties for brand names and patents not used.

(7) Clauses that force the buyer of technology to transfer to the provider the inventions or improvements obtained through the use of that technology.

(8) Clauses that limit and prohibit the exportation of the product manufactured through the acquired tecbnology. In exceptional cases the Committee could allow such clauses, but on no account if they prohibit exports to the member countries of the Cartagena Agreement.

(9) Clauses that guarantee the payment to the provider of minimum annual sums.

(10) Clauses that impose upon the receiver of the concession the payment of the taxes that correspond to the giver of the concession.

(11) Other clauses with similar effects.

To approve contracts for the exploitation of foreign brand names in the country, their contribution to the maintenance, expansion, or acquisition of new foreign markets is especially taken into account.

The contracts for payments for services abroad must also be submitted for consideration to the Exchange Office, which approves or rejects them on the basis of the above-mentioned criteria.

The actual putting into operation of the contract in Colombia is the responsibility of the Royalties Committee in coordination with the Superintendent of the Exchange Control.

The contracts for the buying of intangibles, administration, intellectual property rights, author's rights, etc., which cause payments abroad, must be submitted for the consideration of the Royalties Committee and in such cases, the Committee tries to apply those criteria already mentioned that are compatible with these types of contracts.

To proceed in the evaluation of contracts, the Royalties Committee and the Exchange Office usually look for advice from specialized entities.

When Decision 24 of the Andean Pact came into operation, a serious fault in the Colombian legislation was corrected, as there was no obligation to submit for approval by the Royalties Committee those contracts whose royalties were paid in national currency. Article 18 of Decision 24 established that all contracts for the import of technology must be submitted for approval by the competent organism of the country (in the case of Colombia, the Royalties Committee) without mentioning whether the contract implied spending in foreign currency or not.

In the regulations of Decision 24 it must be made very clear what is understood by "buying of technology." Such a concept should include licences for patents and brand names, know-how, industrial models, chemical formulas, training, quality control, technical assistance, etc. In this way the Royalties Committee would not have its control ridiculed by entrepreneurs who, when unable to get approval for a contract, have applied directly to the Exchange Office of the Bank of the Republic for permission to send payments abroad for technical assistance, a way of buying technology that until now has not been submitted to the Royalties Committee's control.

Operation of the Registry of Technology Transfer: Criteria and Issues (Mexico)

The five causes for the rejection of a contract (contained in Article 7) are actually very difficult to manage because their interpretation may vary in different cases. Since the Registry decides on the merits or deficiencies of each individual contract, it has been necessary to approve internally the criteria that must rule the application of this article (however, the particular circumstances of each contract are always taken into account). It is important to examine briefly the Registry's principal internal criteria (15):

(a) When the price is not related to the acquired technology or constitutes an unjustified or excessive burden on the national economy (Article 7, section II): The preoccupation concerning payments toward foreign countries exists in the Registry's origins. It was estimated that the total sum payed by Mexico to foreign countries for royalties and technical assistance was approximately 2,500 million pesos (16). This amount represented 15% of the export value of that year and the same study predicted that those payments would increase to a rate higher than 20% annually. Consequently, RNTT has payed special attention to this problem.

Nevertheless, it is extremely difficult to give a precise evaluation of the cost of technical know-how. The price of technology is fixed by the influence that the different parties involved in the negotiation have, and that influence is conditioned two factors:

(1) For the buyers to make a correct evaluation of the technology they wish to acquire, they must have information on the technology's characteristics. Nevertheless, the market is very imperfect and the information does not circulate freely. Experience proves that if the buyers had this information they probably would not need to acquire additional information (17).

(2) The buyers' marginal cost, in case they decide to develop the technology, is generally very high, and the marginal cost to commercialize technology for the sellers is very low (frequently reaching zero) (18). This has a very important effect on the position of both parties involved in the negotiation.

Consequently, RNTT has faced the very difficult task of evaluating the price. The general principle is that the total price must be clearly stipulated in the contract. From the sample of 47 contracts examined for this study (19) six had not clearly established the sum that was to be paid (one did not even mention what the form of payment would be); although they broke the golden rule, RNTT had approved and registered them. The second guideline establishes that the taxes related to such payments shall be covered by the enterprise that receives the income (the licensor). But once again, inconsistencies were detected, since in eight contracts the recipient was responsible for paying the taxes caused by the earnings of the enterprise that sold the technology (and in six cases it was a public sector enterprise). Seven of the eight contracts had already been approved.

The criteria indicate that the payment formula stipulated in the contract shall be taken into account. However, preferences are not established among the various forms of payment. These may be of different types: a single cash payment; royalties while a contract is in force, up to a fixed amount or during a specific period of time (calculated on sales, production, volumes, or income-yield capacity rates); payment in shares from the recipient (capitalization of technology); periodic payments (not linked to sales or profitability); separate payments for specific technical services; combinations of the above-mentioned formulas. Evidently, it is more convenient to link royalty payments in equity from the recipient. In fact, this is an essential point and should have been included in the text of the Law on the Registry. Capitalization of technology is not only a form of payment (very costly if the profits that must be paid to the holder of the

shares are taken into account) but it also represents a way of controlling the technology recipient. Therefore, this practice should be forbidden or at least severely limited (20). The use of the different forms of payment will be generally conditioned by the contract's objective (a service rendered in only one act will be paid in cash and will not require continuous payments). The evaluation is very difficult in the case of a complex contract that uses several formulas, because payments cannot be related on a one-to-one basis to the different services included in the contract.

The payments issue is obviously linked to the duration of the agreements. To begin with, no contract may last more than 10 years, an excessively large period for some industrial branches; however, RNTT should define the criteria to reduce the period during which royalties are paid, whenever it is possible. Another important aspect neglected by the Law and the internal criteria is the amount of inputs (raw materials, intermediate goods, and components) that the acquirer shall receive from the licensor. The value of these imports (CIT cost + import taxes + management costs) must be subtracted from the total sum that serves as a basis for the calculation of royalties (whenever these are calculated on scales), so that these are paid on the basis of value added in the recipient's plant. Besides, the internal criteria deal in a very superficial way with the problem of licensor participation in the licensee's equity. The only references on this issue indicate that, as a general rule, royalty payments will not be allowed in licencing agreements regarding trademarks and patents whenever the licensor is a major participant in the licensee's capital. Besides admitting exceptions to the general rule, this criterion excludes any enterprise with a licensor participation of 20% to 30%. Nothing justifies not fixing lower royalty rates in all cases where the participation is higher than 20% (21). Finally, the criteria indicate that royalty payments on duties regarding patent use shall be maintained at the same levels as those of trademarks. Although the problem of the contracts' content will be examined later on, it may be stated that, as a general rule, it is very defective. Trademarks do not constitute technical know-how and their treatment cannot be equaled to the one given to technology (although it is true that in some cases their commercial value is much higher).

The Registry has not established maximum limits on royalty payments by industrial branches. The belief that the Registry only authorizes payments of up to 4% on net sales is unfounded. It originated in the requirement established by the Office of Industrial Promotion so as to have access to the advantages of the recently repealed Law of New and Necessary Industries or the Decree on Decentralization and Industrial Development. Perhaps it is not convenient to fix a limit because it is true that each contract is different, but more precise criteria must be designed to emphasize the advantages and disadvantages of the various formulas within the particular economic context of Mexico. The real problem in the payments issue refers to the type of goods that should be produced. The Registry indicates that section II of Article 7 must be interpreted in the sense of evaluating the payments in both private and social terms. But although the methodologies for project evaluation in terms of their social-cost benefits have severe deficiencies (a fundamental one being the fact that generally a project is not valued in relationship to other alternative projects), RNTT has not had, up to the present time, the technical capacity to accomplish an analysis of the payments from this point of view. It must be added that unfortunately there is no legal basis to limit technology royalty payments to produce cosmetics or to apply trademarks for luxury garments.

(b) When excessive terms of duration are established (which under no circumstances may exceed 10 years) (Article 7, section XIII): The duration of an agreement must generally be determined according to the type of technology that is being transferred; but a period of less than 10 years is considered to be more than sufficient for an adequate assimilation (or even adaptation) of the acquired technology. The Registry establishes that in those cases where technology can be assimilated in a shorter period of time, the 10-year duration shall not be authorized. But it also establishes that contracts that can be extended automatically for specific periods of time shall be approved only when the licensee has the option to conclude the contract in any of those periods, and when the initial term does not exceed 10 years. When this possibility is admitted, the initial resolution that clearly states that no exception shall be allowed is contradicted. A contract's extension is admissible only when it will lead to improvements or to new know-how (developed by the licensor during the period when the initial contract is in force). The Registry does not mention the fact that the term must be evaluated according to the payments and technology included in the contract. Evidently, when the technology is found in a sector of rapid technical change, the licensee who

accepts a 10-year term will be paying during the last 2 or 3 years royalties for a technology whose life cycle has concluded. And in the case of a more conventional technology in a branch of limited dynamism, the licensee will generally be able to absorb it in a period of 5 years.

According to the Registry's criteria, a contract will be admitted when a term to protect the confidential information furnished by the licensee is established, provided that such a term does not exceed 10 years from the date the information is received. It is not clear whether the term must begin from the last receiving date (in the hypothetical case where the information could be divided) and be periodically delivered or from the initiation of the contract. But since the Registry admits contracts where the licensee still has obligations after the termination of the agreement (provided that it does not last longer than the term stated by the Law) (22), one must interpret that the obligation to respect the confidentiality is valid, even after the date the contract ends. To sum up, the interpretation of this section is very unfortunate because the Law does not authorize the establishment of any obligations after the contract ceases to be in effect. Instead, when section XIII prohibits excessively long terms, it clearly rejects the obligations that in fact prolong the life of a contract beyond its conclusion. The proverb that "whatever is not forbidden is permitted" does not apply in this case. Finally, the internal criteria do not make any reference to the problem concerning the clauses on the termination of the contracts. There are many varieties of this type of clause; however, the use of clauses that allow the licensor to end a contract in an unilateral way without a justifiable cause must be rejected. The involuntary breach of contract is not a justifiable cause. The clauses on unforeseen circumstances must be clear and must be carefully stated to prevent abuses. In any case, the licensee should be able to use the information included in the contract, even after its conclusion.

(c) When the object of the contract is the transfer of technology freely available in the country (Article 7, section I): Apparently this section does not present any major problems in its interpretation and application. Its purpose is to avoid the celebration of contracts that include licences on patents that have become part of the public domain (because they have either expired or become void) or on unpatented information in the public domain. Another guideline is that the contract shall not be accepted when it involves know-how that the recipient is able to carry out by himself, without any additional cost. In those cases where a Mexican research centre is willing to furnish free technology and the same conditions are offered by a foreign supplier, the contract shall not be approved (that is to say, the acquirer shall be forced to obtain the technology from the R&D centre or to accept not having it at all). But in all of these cases, the Registry stipulates that this section shall be applied if the free technology available in the country is substantially similar to the one they wish to import; that is to say, that its characteristics, yields, and specifications are fundamentally the same.

In practice this section has no value. The text of the Law itself nullifies the potential of this regulation to substitute the import of technologies, because the word "free" places the possible national suppliers in a disadvantageous position: in fact, they must be able to provide the know-how for free. The literature emphasizes the fact that research and experimental development need to be compensated for (through adequate payments of royalties, duration of patents, etc.); therefore it is not clear why, in the case of a national supplier, these considerations have no application. It would have been better to leave the possibility open for a technical advisory committee, with sufficient information on national suppliers of technology in the various industrial branches, to be in charge of deciding if the technology was substantially similar and with the power of determining under which conditions (cost, duration of the contract, etc.) the transfer should be carried out (23).

The Registry states that a contract shall not be authorized either whenever the recipient himself is able to acquire the knowledge included in the contract without an additional cost. This guideline is undoubtedly a dead letter in practice, because it supposes that an evaluation of the recipient's technical capacity should be carried out to determine if the company itself can have access to that information. Nevertheless, it is not such a bad idea, because section I must be applied in those cases where the transferred technology has not become part of the public domain but is easy to copy without the risks of invading previously acquired industrial property rights. Copying is an extraordinarily useful method of acquiring technology and perhaps it is the least costly. The criticism of the big patent lawyers' offices in the sense that copying is illegal and equivalent to piracy, lacks legal bases, and from the point of view of an autonomous

technological development strategy, it implies turning away from a very useful instrument. A technological copy often implies substantial modifications and adaptations that alter the characteristics of the copied technology in such a way that it is legally untenable to attack it. This is why the patent system has lost so much importance, in spite of the patent lawyers, its principal beneficiaries (24). The Mexican state must abandon the narrow legalistic positions that discourage copying, and establish instruments that promote it in a responsible and selective way. Copying evidently implies costs, and that is precisely why it could be supported with technical and legal assistance.

(d) When various restrictions for the purchaser are established (various sections of Article 7): The abuses and restrictions that RNTT seeks to eliminate are classified under two categories: those that can never be permitted, and those where exeptions are allowed (25).

Among the first is found the obligation to submit (in an onerous or gratuitous way) to the technology supplier all innovations or improvements obtained by the purchaser (section IV, Article 7), when limitations to the purchaser's research or technological developments are set up (section V, Article 7) and when exportation of goods and services produced by the purchaser is forbidden or restricted in a way contrary to the country's interests (section VII, Article 7). Besides, no exceptions are allowed when the technology is freely available in the country (section I), when the life span of the contract is excessively long (section XIII), and when acknowledgement of lawsuits arising from the contract's interpretation or execution is submitted to foreign courts (section XIV).

However, the Registry admits contracts in which there exists a reciprocal obligation of interchanging information developed by any of the two parties: this criterion goes against the Law, because in this point no exceptions whatsoever are admitted (26). The way the Registry interprets section V is still more serious. This section forbids restrictions on R&D carried out by the purchaser. The Registry accepts contracts in which the incorporation of improvements is justifiably limited or conditioned, especially when trademarks are involved in the contracts. In the first place, the Law clearly established that no exceptions whatever will be accepted concerning this section (there can be no justifiable causes). In the second place, this criterion is opposed to the objective of adapting foreign technology to local conditions. Finally, it is precisely when trademarks are involved in the contract that the state considers that bases have been found to introduce the type of limitations that strengthen the purchaser's dependency vis-à-vis the supplier. This interpretation is in conflict with section VIII of this same article that rejects any prohibitions in using complementary technologies. But again, the Registry accepts contracts with this limitation when the use of trademarks (property of the licensor) is included. This interpretation is incorrect, because it weakens once more the purchaser's position. In any case, a difference between limitations in using complementary technology at the product level and production technologies should be established. In the latter ones, no limitation would be justifiable. In short, it seems that RNTT grants special treatment to those contracts involving trademarks, thus recognizing the strong dependency (which increases everyday) established toward the supplier whenever this element is involved. It would be better to put aside so many exceptions and to stipulate that the use of foreign trademarks for exportation should be linked to national trademarks so that, when the contract expires, the purchasers would be able to have access to the market cultivated by them during the contract's life span. The use of new foreign trademarks for products destined to a national market must be discontinued.

In regard to restrictions on exportation, it is necessary to point out that RNTT accepts limitations that might result from national legislations of the technology supplier. This refers, in particular, to those cases in which a foreign enterprise (for example, a North American one) is limited by legal or regulatory dispositions pertaining to that country and that have to do with exporting to certain countries (Cuba, for example). Before setting up a general rule, the Registry must first proceed to analyze, in collaboration with specialized organisms in foreign trade, if the possibility of exporting to those countries really exists. Other Latin American countries have operated in this way and have forced the United States Department of Commerce to authorize these exports.

Finally, it has been said that section III, which prohibits intervention from the licensor in what concerns licensee administration, constitutes an incentive to transfer technology linked to capital mainly through joint ventures. This way of transferring

seems to be preferred by technology suppliers for it ensures a greater price and also a greater control (particularly when the technology can be rapidly assimilated, ending thus with the receiver's dependency toward the supplier). It is difficult to speculate on these effects of section III; however, RNTT makes room for some exceptions (among others, when the contract involves trademarks and when assistance is oriented toward maintaining quality levels). A recent analysis of the Registry's criteria reached the conclusion that even if the contracting parties would consider this possibility to evade the application of the Law, it would still be necessary for the National Commission on Foreign Investments to authorize the establishment of these types of enterprises (27). This, however, is incorrect, for according to the Commission's interpretation of the Law to promote Mexican investment and regulate foreign investment, such authorization is not required when a new enterprise is set up with a maximum foreign participation of 49% (or with the specific limits established for certain industrial branches).

Registry Functions; Evaluation

Some Special Issues in the Operation of the Registry of Licencing Agreements (Argentina)

It is well known that supplier-customer relationships exert a strong influence on the choice of technologies and, hence, on the selection of technology suppliers. This is the case particularly in assembly industries. In these industries, large assembly - and frequently foreign-controlled - enterprises are often able to impose the specifications, tools, and designs to be used by their local parts-suppliers to be admitted as eligible.

In many cases, these foreign firms capable of furnishing the local parts-suppliers with the necessary technology inputs required to meet their customers' requirements are also the parts-suppliers of the latter's parent firms. These requirements of customer firms reinforce the technology suppliers' bargaining power. Here then is a case of rigidity in the choice of technologies, clearly due to parent-subsidiary and supplier-customer links, which may be disadvantageous from the point of view of the recipient economy (28).

The point is that at least some important state-owned and controlled enterprises (because of deeply rooted habits or otherwise) appear to behave in a similar fashion, raising therefore the same types of problems.

Normally, state enterprises call a tender when it is a matter of large projects. This specifies a set of economic, technical, and legal requirements to be met by the bidders. Thus, there is an implicit preselection of potential technology suppliers stemming from the preferences set by the state enterprises as regards those requirements. The problem arises when this procedure leads to the favouring of certain foreign technology suppliers who are thus able to exert a strong pressure regarding the terms of their licence agreements. And these terms may conflict with the stipulations of the Transfer of Technology Law (29).

There is a case in point relating to a large state enterprise in a Latin American country. It called a tender for the supply of a large series of a certain line of capital goods in the framework of a vast program aimed at replacing and increasing existing transportation capacity.

The particular feature of this tender was that it required capital goods of a particular trademark. This trademark was owned and controlled worldwide by an American firm. So, notwithstanding preferences granted to local firms vis-à-vis firms from abroad, the only supplier strictly qualified to win the tender was the American firm. In fact, there was also another bidder: the only local producer of the needed line of capital goods, under licence to the U.S. firm (this local enterprise is, in turn, a wholly owned subsidiary of a European corporation). It appears that for the U.S. firm the deal would have been as profitable - or perhaps more so - by bidding through the local licensee as by bidding in its own name, because in the latter case the import-substitution incentive should have been ruled out.

The wholly foreign-owned licensee naturally won the tender. Then the licencing contract was applied for registration, and the technology authority found not only that the American firm had taken undue advantage of its privileged bargaining position (over and above what is allowed by the Transfer of Technology Law (30)) but, more essentially, that there was not to be any genuine transfer of technology: only the right to use the

trademark, since the local firm was capable of supplying the capital goods by resorting to its own technical capacity, and with little or no foreign collaboration. Despite this, the technology authority was itself confronted with a fait accompli. The tender had already been won.

The state enterprise did not want to delay the operation any longer. The supplier was already in a position to start production. The authority's refusal to grant legal recognition to the contract would have been viewed - in the most favourable of cases - as a purely bureaucratic obstruction to the realization of the program. The negotiations are still under way.

A second case involves a state enterprise that applied for approval of a contract with an American engineering firm that was to supply process technology, engineering services, training, and supervision for construction and start-up for an important project aimed at substituting imports in the petrochemical industry.

The technology authority pointed out a series of modifications necessary for the contract to be duly registered. The parties to the agreement satisfied most of these requirements, but the licensor was not prepared to introduce any changes in a clause relating to the recipient's right to increase capacity unless a new contract was undertaken.

This was taken as violating the Law regarding two points: (a) the prohibition for the licensor to regulate the licensee's production; and (b) the licensee's right to make free use of the licenced technology at the expiration of the contract, provided that the technology is not protected by industrial property rights.

Once again, the project was already well under way and it was considered as a first priority because of its forward and backward linkages and the important foreign exchange savings it was to bring about. The authority could not afford to be rigid in the application of the Law. The contract was granted approval (31).

This case highlights a lack of consistency in the Law, which uses the word "acquisition" of foreign technology when the fact is that local firms do not acquire foreign technology: they are only granted the right to exploit it; licensors' proprietary rights are not at all transferred. This gives rise to difficulties in enforcing Article 7 of the Law, by which the licensee should have the right to make free use of the licenced technology provided that it is not protected by industrial property rights. In fact the Law does not prohibit clauses violating Article 7. They are just considered as non-existent. So, particularly in process industries where they are more crucial, they remain in the contracts. Since local firms (including state-owned ones) are not too keen to take advantage of the Law in this respect, the situation is quite acceptable as far as technology suppliers are concerned.

A third and rather controversial point about the Argentinian Transfer of Technology Law is the one concerning the tax treatment to be given to royalty and fee payments abroad.

According to the Law (Article 5h), when there is a tax-credit system in the country of the licensor, the licence agreement must set royalty and fee payments on a gross basis. Put in another way, it is the licensor who must afford the Argentinian income tax. The rationale behind this provision seems quite straightforward: the income tax should accrue to the country that is the source of the income. This is a generally accepted principle of international taxation, and seems fair enough.

Obviously, if there was not a tax-credit system in the licensor's country of origin, such an obligation would lead to double taxation. This situation would most likely lead, in turn, to higher prices, because the licensor will try to pass the burden on to the licensee.

Capital-exporting countries usually implement tax-credit systems (thus recognizing the principle of taxation at the source) to avoid double taxation on residents with foreign sources of income. The key to these systems is the income-tax differential. If the tax rate is lower abroad than at home, the firm will levy nothing at home.

As far as technology-recipient countries are concerned, the first is the usual case (that is, their income-tax rate is lower than in technology-exporting countries, which from a purely fiscal standpoint does not look very wise, though it may be taken as affecting favourably the foreign corporations' decisions to invest, which is atleast arguable). Hence, from the standpoint of the technology suppliers from an advanced

industrial country with a tax-credit scheme, there would be no difference where they have to levy the income tax, insofar as the tax-rate is lower abroad than at home and insofar as they can get the after-tax income they planned.

If the recipient country's policy is oriented to the maximization of income-tax earnings, the thing to do is (a) to raise the income-tax rate so as to equalize it with that prevailing in the technology-source countries, and (b) to tax the licensor (rather than the licensee) so as to obtain the highest possible taxable income.

Now, while there does not seem to be any trouble with (a), this is not so with (b), which leads to higher technology import costs, because the licensor will raise the price (royalties and fees) correspondingly, to get the after-tax income originally planned for the operation. In this way, the recipient country must choose whether to get higher tax earnings with higher technology import costs or lower tax earnings with lower technology import costs.

One possible way to get around this difficulty may be to tax royalty and fee remissions abroad only (allowing licensees to afford the income tax). But this may not be practical because the Transfer of Technology Law impedes the capitalization of royalties (as an alternative) in the recipient country. The matter is open to further research.

A fourth issue refers to the export restrictions that are usually ruled out by transfer of technology statutes. The question is to what extent are these prohibitions actually effective as a way of promoting exports by firms producing under licence, particularly when licensors are not prepared to allow them to do it (over and above what is ruled by the Law), even though recipient firms may be capable of engaging in export trade?

One example of this difficulty is the case where the licensor grants exclusive rights for commercialization to each licensee within their respective countries. This per se does not appear to violate the Transfer of Technology Law. However, the licensee of one country is in fact, as a result, inhibited from competing in those countries where other licensees of the same technology supplier have been granted exclusivity, and this is equivalent to an export restriction clause. There is little an isolated country can do about this.

The first two cases analyzed allow for a few interesting conclusions. First, when it is a matter of very large projects (particularly if they are state-sponsored and considered critical from the standpoint of the import substitution strategy), the technology authority usually comes on stage too late in the process, when negotiations and the execution of the projects are already well under way. This situation should be changed by granting the technology authority an active role from the very start.

Second, enterprises do not see themselves as having much responsibility concerning scientific and technological policies. They normally plan their investment projects and business activities without bothering too much about the development of national scientific and technological capabilities. They are, in fact, good customers for turn-key plant suppliers, because this option simplifies things for state enterprises' managers, who are hardly prepared to run the risks involved in disaggregating technology packages or taking an innovative approach in their management of technological matters.

Third, the technology authority behaves quite often as one more negotiator rather than as an agency in charge of drawing the contracts strictly in line with the stipulations of the Law. The authority negotiates for the contracts to be as advantageous as possible from the point of view of the national interest.

It should be recalled here that the Argentinian Transfer of Technology Law allows for two types of situations: those contracts that cannot be given local recognition, and those that may not be given recognition by the technology authority. This allows for a certain degree of flexibility and discretionary power, which will be used to different extents according to circumstances (32).

Another issue that was raised points to an actual conflict between fiscal objectives and balance-of-payments considerations, which has not yet been solved.

Finally, the last issue examined refers to an instance where the only way out is by reaching international agreements among recipient countries to make their respective policies compatible and avoid them being levered one against the others.

Performance and Capacity (Colombia)

In relation to the problems and deficiencies that have arisen in the working of this institutional system, it is worth presenting here the conclusions reached by a recent observer of these institutions in Colombia (33):

(1) Public officials in developing countries lack the knowledge necessary to coordinate the novelty of technology offered with the needs in the economic and social plans of the government, and as a result do not carry out an evaluation of the real economic and scientific contribution that the technologies contained in the contract offer to the country.

(2) On the whole the public officials of such countries are dedicated to multiple government activities unconnected with the evaluation of contracts, and as a result may lack the time and the means to remain permanently informed of the latest advances in science and technology. To judge, under these conditions, whether the technology offered is really new on the world market becomes practically impossible. And often what is bought is fairly out-of-date technology, which in the country of origin has already been surpassed and abandoned.

(3) The above has a logical development in the fact that one cannot really know the offerers and cannot judge, therefore, if they are real leaders in their field, and in a condition to offer permanent assistance for new advances. With these limitations it is hardly surprising that sometimes contracts are authorized with very inferior firms who will soon be surpassed by the licensees, and therefore do not offer the assistance desired, and limit the receiver's access to new technological developments.

This point has repercussions in other fields. The same Decision 24, for example, states that it does not authorize contracts between headquarters and branches, to avoid the drawing of profits disguised as royalties, and uses the philosophy that headquarters should provide for new sub branches the necessary elements for adequate economic progress, without affecting the country's balance of payments.

However, in the majority of cases, the transnational corporations have adopted financial systems that make it practically impossible to determine the relation between an investment abroad and who is really responsible for it, and it is getting easier and easier for the persons who appear as the licensers to show they have no link with the headquarters of the licensees; when really, through a complicated financial system, the transnational corporation is both the licenser and licensee or the licenser is the owner of the firm that is acquiring the license.

The above corroborates that in most cases the elements of judgment available to developing countries are not sufficient to determine whether the technology suppliers are real leaders in their field or not, and whether they are capable of giving permanent technical assistance throughout the contract or of offering new advances as these appear on the world technological scene.

Although it may seem incredible, experience shows that the public officials of developing countries seldom know the productive system of the country in detail and are therefore handicapped in judging whether this system is capable of assimilating rapidly and effectively the technology bought. They cannot judge either whether it can be used with the existing methods or whether innovations will have to be made to machinery or equipment which, as they are imported, cancel out the apparently favourable effects on the balance of payments, whether its use will affect the labour composition in the firms, whether the national raw materials will be, or can be, used, etc.

Neither is there a very precise knowledge of the country's scientific and technological system, and therefore it is not possible to judge whether the technology could be generated within it or whether some components of the total package could be obtained easily and locally. Neither is there a sufficient basis to analyze whether the technology will be usable in the form in which it is obtained or whether some adaptations are needed, and to what extent; and as a result of the above, there are no sure methods to determine whether the scientific-technological system is capable of carrying out such adaptations.

Lack of knowledge of the world market in technology naturally exerts an influence at the moment of analyzing the price to be paid for it. Lack of information about whether alternative sources exist and what conditions are involved, or whether it would be feasible to resort to substantive processes, makes it difficult to measure with any degree

of accuracy the market meaning of the stipulated price. For this reason it is generally necessary to proceed in a purely intuitive way in accepting or not the price demanded and with the sole criterion that any reduction made implies a success in the negotiation.

Moreover, there is a serious lack of coordination among the government organisms involved in industrial problems and the evaluation of technology, so that on many occasions valuable information that is urgently needed is not available at the moment of judging the contracts, despite the fact that it is, in some cases, at the disposal of entities connected with the industrial system, because its importance is lost amid the complicated, and at times incoherent, system of government information.

THE PATENT SYSTEM

Patents have always had an ambiguous role in developing countries. Originally given as an encouragement or reward to the individual inventor, patents are now principally corporate or firm property. The property rights inherent in a patent no longer defend, therefore, the small inventor but the large corporation. This shift, which took place over the last 80 years, has been accompanied by another; the expansion of world trade has not only increased the value of multicountry patenting, but has also led developing countries to produce and export industrial, possibly patented, goods.

Patent rights have therefore been the subject of an intense debate in STPI countries. Many commentators have questioned the whole value of the international patent system, with its explicit monopoly rights, for developing countries. Patents would seem to preserve production rights for foreign producers in domestic markets by the use of developing countries laws. Some countries have accepted the value of a patent system, but have changed the granting conditions. Several countries have restricted patent rights by limiting the time allowed for protection, their product or process coverage, and licencing or exploitation rules. In changing their patent laws, many countries have redefined the patent from an individual to a social right (see the description of Peru).

Data from the STPI countries that undertook an analysis of patents show consistent trends. Patent grants have increased, but both individual and national patent holders constitute a smaller and smaller proportion of the total. The majority of patents in these countries are held by foreign corporations.

The major claim for the patent system, that it encourages invention, is examined in the description of Mexico. Although there were variations in the three sectors - food, capital goods, and petrochemicals - there was little evidence that patents encouraged inventiveness or industrial creativity. The same description also examines the role of patents in the technology transfer process and finds that they constitute a small proportion of all disembodied technology. Finally, the description of Venezuela looks at arguments for the patent system in terms of its contribution to development. Little theoretic or empirical evidence is found to support the most ambitious claims for the system. In summary, there is little enthusiasm for the international patent system.

Industrial Property Rights (Peru)

The legal provision contained in the Regulations of the General Law of Industries D.L. 18350 came into force on 25 January 1971. This provision operates in the industrial sector and regulates the industrial property system in Peru. It contains the standards that regulate the operation and application of the elements constituting industrial property, to wit:

- letters patents
- industrial designs
- technological procedures
- manufacturers' trademarks
- names, trade names, and slogans.

The main aspects covered by this provision are the following:

(1) It guarantees industrial property so long as it contributes to industrial development, is of social interest, and does not go against ethics.

(2) It establishes the right of owners of any element of industrial property to grant a licence for its use or to transfer it to third parties through a contract.

(3) All persons have the right to patent their inventions according to the provision, which also defines the necessary procedures and requirements for obtaining the patent.

(4) It establishes the commitment of the owners of patents to limit their initiation of the patents' implementation to within not more than 2 years, which can be extended a single time.

(5) The duration of the patent is fixed at 10 years with exclusive exploitation rights in the country.

(6) With regard to industrial designs, it establishes the right of any persons to request recognition of their exclusive right over all their own industrial designs, commercial names, or slogans.

(7) It provides for the protection of all technological procedures against illicit use or publication so long as they are effectively novel and measures have been taken to preserve their secret nature.

(8) It provides the standards and procedures for registering trademarks, names, and slogans.

In the case of industrial designs, it is indicated that any natural or juristic persons can request recognition of their right and registration of any form, shape, ornament, or drawing applicable to an industrial article. The exclusive right to a design is granted for 5 years.

In the same way, the necessary standards for granting and using the rights of technological procedures and manufacturers' trademarks are specified.

The Role of Patents in Industry (Mexico)

Through the survey carried out on a sample of 67 enterprises, the unique role that the patents play in each industrial branch could be observed. The greatest concentration of patents was found in the area of capital goods: seven enterprises out of 25 declared they had registered patents and two indicated they had applications in process to obtain them. In the petrochemical industry, only two (national enterprises) out of 18 were holders of patents and one (subsidiary) had initiated the proceedings to obtain them. In the food industry, only one (a subsidiary with 100% foreign capital) out of the 24 enterprises had registered patents. There are many reasons that explain this phenomenon. In the first place, almost all the processes used in the food industry are in the public domain (and in many countries they are not even patentable); in this case, the function of the trademarks is much more important than the patents. In the petrochemical industries considered in the study, the patents hardly give an effective protection to a process that can be copied with relative ease - this is particularly true in the case of synthetic resins. In this case, the barriers to entry lie in the huge amounts of investment needed, and large enterprises are not worried about competition generated by small units. Generally speaking, large enterprises retain a suitable number of patents to protect fundamental processes, and that which is considered hard to protect, even through industrial property rights, is kept by the enterprise in its patrimony by means of the industrial secret.

Apparently, the situation is different in the case of capital goods since the survey's data seem to suggest that patents have a greater importance. Nevertheless, the possibilities of copying and of using patents that do not belong to the enterprise are quite high in some of the goods that have been taken into account: such is the case with the more conventional machine tools. Besides, it is important to point out that five out of the seven enterprises with patents were subsidiaries of transnational enterprises. This could more likely be interpreted as a head office's interest in protecting the subsidiary's market and in increasing the degree of oligopolistic control (preventing local production or avoiding importation) than as an answer to the incentive of innovating or as a desire to protect an invention.

It would be convenient to point out that the number of registered patents by the different types of enterprises reveals the so-called propensity to patent of each enterprise (34). Generally speaking, small enterprises, because of their weaker position, have a greater propensity to patent and to look for additional protection. Larger enterprises have a bigger structure and are therefore more confident of their position in industry. Besides, this propensity varies in each industrial branch according to the patents'

function and to the nature of both processes and products.

Those who support the existence and the strengthening of the patent system maintain that it is the principal instrument in promoting creative activity. The reasons why the visited enterprises carried out research and experimental development tasks (R&D), however, are of a different nature. Table 7 contains information on the factors that most relevantly influenced the decision of 44 enterprises to invest time and funds to carry out this activity. The enterprises in Table 7 performed at least one of the following activities: applied research, experimental development, design and engineering design. The most frequently mentioned factor in all three areas was the "need to reduce costs." Immediately after this came "pressure from competition." (Different from the need to reduce costs is the need to introduce innovations in product or materials technology stemming from the need to diversify.) In the fourth place, and after "other reasons" (35), the "possibility of generating patents" was mentioned in 11 out of the 44 enterprises. Nine of these enterprises have quite a high participation of foreign capital (the average participation in the equity of these nine enterprises is above 37%) (36). This indicates that the interest in the possibility of generating patents exists fundamentally in those enterprises whose capital structure has high foreign participation.

But the link with foreign units is not only financial: 28 out of the 44 enterprises (10 in capital goods, 10 in petrochemicals, eight in the food industry) participated in at least one agreement of patented or unpatented technology licence, trademark, or technical assistance. Out of these same 44 enterprises, only 16 declared that all of the technology used by them, at the time of the survey, was their own: in the other cases, the technology had been developed in other countries and they had access to it by means of the corresponding contract.

For various reasons, national firms do not carry out an intense activity to obtain patents. First, their technological weakness (there is no carrying out of R&D activities and very little adaptation of foreign technology) prevents them from generating patentable know-how. Paradoxically, the patent system does not seem to be a sufficiently powerful incentive to encourage the promotion of these activities within national enterprises. Second, there is quite a bit of ignorance (and mistrust) regarding this instrument. Technical assistance services that could help Mexican enterprises explore the possibilities of patenting generated know-how have never been established. Third, except for a few industries, patents do not represent an efficient protection. The most powerful instruments used in protecting the enterprise's position seem to be the industrial secret and the relative advantage gained by being somewhat ahead when an innovation has been introduced.

For these and other reasons, some authors have reached the conclusion that the patent system in Mexico has lost all of its significance. A possible explanation could be that in Mexico there are other instruments of industrial policy that also operate through the incentive of a protected market: tariffs and quantitative controls on imports might not grant a monopolistic privilege, but they certainly offer a very tight protection, even an infinite one as in the case of quantitative controls. Therefore, it is possible that to obtain the necessary protection in an economic system such as the Mexican one, the patent system might not be very useful.

Patents have also lost importance in the process of technology marketing among enterprises. Various studies, beginning with a first one on this subject by the United Nations in 1964 (37), have confirmed that in technology-marketing agreements, patents have become less and less important and have been displaced by other elements: unpatented know-how, technical assistance, etc. Of course, this situation is different in those sectors in which patents still perform an important protective function, but even then other industrial property rights play a more significant role (such is the case with trademarks and brand names). The reasons for this could be the following: (a) the patent system has simply lost its protective force (except for some industrial branches) and has been displaced by industrial secrecy (38), (b) other industrial property rights have proven to be more effective in protecting and controlling a market (which is what a patent offers); (c) it is not necessary to include a patent in a technology-marketing agreement to include restrictive (or tie-in) clauses: the inclusion of this type of clause can be achieved through unpatented know-how and trademarks. Agreements on unpatented technology licences that do not involve patents are frequently found; however, a vast majority of patent licence contracts involve unpatented technical know-how licences. In fact, unpatented know-how, previously considered as an appendix to the contract's principal purpose, has become, in many cases, the essence of the agreement (39).

To analyze the role that patents play in this process, the enterprises' executives were questionned on the technology contracts' contents (if the enterprise had entered into one or more of them). Each contract's content was subdivided into the following elements: patents, trademarks, know-how, technical assistance, engineering services (basic and detail), administrative services, and other services. As shown in Table 8, the most frequent element in the contracts was technical assistance (34 out of the 37 enterprises holding contracts mentioned this element); it was followed by patents (25), unpatented know-how (25), and trademarks (24). In none of the selected branches did patents appear as the most frequent element. In petrochemicals, patents were surpassed by technical assistance and unpatented know-how; in the food industry, they were surpassed by trademarks and technical assistance. In the capital goods branch, patents were only surpassed by technical assistance; this reflects the relative importance of patents in this branch. When one analyzes the enterprises holding contracts in this branch, one becomes aware of the fact that only four are producers of machine tools (in medium models) and that in two cases technology was linked to equity participation in the enterprise. The remaining cases were constituted by producers of construction machinery and agricultural machinery and implements; most of these were subsidiaries of transnational enterprises (nine cases) with the head office acting as the licensor. Most of the elements in these cases were included in the contracts: This might reveal the fact that the head office puts all of its know-how, brand names, and trademarks at the subsidiary's disposal.

Another interesting aspect is that contracts having patents as their only element were never found: they always involved a supply of technical know-how and of technical assistance. However, both in the capital goods branch and in petrochemicals, unpatented know-how contracts and technical assistance that did not involve patents were found (one in capital goods and six in petrochemicals).

It is necessary to point out that the results of this part of the survey could overestimate the importance of patents for the following reasons. In many cases it was impossible to obtain the number of contracts in which the enterprise participated as licensees, and only data concerning the contents were available. When visited, various enterprises held more than one contract and possibly some of these documents did not include patents. The number of contracts was provided by 25 enterprises, distributed among the three branches. In 11 cases the enterprise figured as recipient in more than one technology contract; eight enterprises held two contracts, two held three, and one held 12 contracts. The data on the contracts' contents could not be obtained for each contract; therefore, this process amounts to relating patents to the number of enterprises and not to the number of technology contracts. Finally, in some cases, a desire to justify the existence of a contract through the richness or complexity of its content could have been present in the mind of the person interviewed: How could one accept the fact that the "most important legal institution" on this type of agreement should not be included in his contracts?

Therefore, the survey system lacks precision in the examination of the contracts. To correct its deficiencies, a sample of 1,480 contracts, obtained from the National Registry of the Transfer of Technology, was analyzed (40). This sample was obtained from contracts presented for information purposes, that is, contracts that were in force when the Law on the National Registry of the Transfer of Technology went into effect, and therefore it reflects the status quo previous to this instrument's existence. It is not illogical, however, to assume that the Registry does not affect the presence or the absence of patents in the contracts. The conclusions reached by this analysis cover all of the branches in the manufacturing industry and they reveal, in a clear way, the loss in importance of patents in the process of the transfer of technology. The elements that were most frequently included in the contracts are shown in Table 9.

This means that less than one-fourth of the contracts included one or more patents. Almost 60%, however, included trademarks and 55% included technical know-how. If these percentages are compared with the data presented in Table 8, one can confirm that the survey overestimated the importance of patents.

On the other hand, the fact that patents usually go together with the supply of technical know-how or with some type of technical assistance is also confirmed; out of the 315 contracts involving patients, 214 included at least one of these two elements (if not both). Cases in which the object of the contract was the licence for a patent or for many patents without involving any other elements were scarce. However, 88 contracts dealt only with the supply of technical know-how, 32 with technical assistance,

and 205 with both, making this a total of 325.

The presence of patents in contracts varies in the different branches of industry. At a two-digit level of the industrial classification, the branches in which patents were most frequently found in contracts are shown in Table 10.

These industries must not necessarily be classified as being of rapid technological change. Besides, in all of them, the proportion of contracts involving technical know-how or technical assistance was always greater. The results of this analysis when carried out at a level of greater disaggregation of industrial classification are similar. The analysis, at a three-digit level, was carried out for the six branches holding the greatest number of contracts (together they had 929 contracts). Those branches are the following:

31	Chemical products	440 contracts
37	Electrical machinery and equipment	163 "
36	Nonelectrical machinery and equipment	136 "
35	Metallic products	74 "
20	Food products	65 "
38	Transportation equipment	51 "

None of the subgroups had patents as the most frequent element in the contracts. Subgroups in which patents appeared most frequently are shown in Table 11 (information on the frequency of trademarks, technical know-how, and technical assistance is included to compare the relative importance of each of these elements).

The data simply corroborate the hypothesis that the importance of patents in technology marketing was overestimated. In only one subgroup (318) were patents more frequent than technical assistance; in the remaining subgroups, patents were surpassed by the other elements. In conclusion, patents are at present not the fundamental element in contracts on technology.

Main Implications of the Patent Law (Venezuela)

Until recently, when the preoccupation with technological development in Latin America and in the less-industrialized nations was just beginning to build up, specialized literature began to centre its attention on the patent system. Patents were considered to be the crux of the problem and thus became a basic theme for research.

Later on, however, new research projects looked at the problem in a better way. Without underestimating the role of patents, these new research projects have broadened our understanding of other aspects and have concluded that the role of patents has been exaggerated, both in the diagnostic studies of technological questions in developing countries and in reform plans that seek to introduce changes.

From this point of view, the Venezuelan Industrial Property Law is examined and an attempt is made to measure its meaning in relation to three fundamental aspects: (a) local innovative activity; (b) diffusion of technological progress; and (c) technology transfer.

(a) The Patent System and Local Innovative Activity: Patents as a stimulus for the generation of new products and processes have been losing importance even in developed countries. There, large firms have alternative means for protection, guaranteeing them the right of exclusive exploitation and considerable economic benefits.

In Venezuela, this function of patents virtually never existed. The number of national innovations registered is minimal. This shows in the first place Venezuela's technological weakness, but also the small importance given to patents and the lack of interest in obtaining patent rights. If one examines the data for 1965 to 1969, it is easy to see that local patents are not only a very small portion of the total but also are decreasing in number. In 1969, only 26 patents (2.5%) were registered.

The study of some innovating firms (in spite of the small number of firms interviewed) reveals that patents do not play any significant role. The firms interviewed showed little knowledge of the law and in particular of the procedures adopted for the granting of patents, and declared that they would prefer to keep any innovation as an industrial secret. The people interviewed who were directly involved in the generation of innovations paid no attention to patents because they considered theirs to be minor innovations (Jorge Katz). In these minor cases, legal protection makes little sense

because they cannot be used by competitors, and even if they could be this would not alter the position of the innovating firm in the market.

The situation in research and development institutions is similar. Apparently in this case the patent system has not played practically any role either. The 1978 figures show that only three patents were registered by 311 institutions that declared themselves to be carrying out research and development activities. Even if many of these institutions work in fields where patents are not permitted (public health, for instance), the figure quoted is extremely small. The reasons behind this situation are, it seems, the same as in the previous case: patents are not considered important, the law is unknown, and other forms of protection are preferred. Briefly, all the available evidence supports the idea that the possibility of monopolistic exploitation of a new product or process as a result of the exclusive rights inherent in the patent system is not relevant in Venezuela.

(b) The Patent System and its Significance for the Diffusion of Technological Progress: It is claimed, that the patent system also plays an important role in the diffusion of technological information and thus as a support for technological progress. For that motive, the Industrial Property Law establishes that the archives of the Patent Registry should be open to the public (Articles 40 and 41) and also that a bulletin should be published (Article 54). These two mechanisms put into effect the current legislation on the diffusion of registered information. Their efficiency must nevertheless be seriously questioned due to the organization and functioning of the Registry. For instance, the only criterion followed for the classification of patents is the order in which they have arrived to be registered. Under such a system it becomes impossible for anybody interested in the information to know about the existence or nonexistence, the characteristics, and the conditions (exploited or nonexploited, freely available or not, etc.) of patents related to a given industry. To use the archives, interested persons would have to take on the most tedious task of reviewing all the bulletins and of selecting the registration numbers of the innovations that they are interested in, on the basis of the scant information that the bulletins provide. After that they would have to go on to examine the selected patents case by case.

But even if these limitations were overcome (as is being attempted by adopting the international patent classification system) the diffusion role of the patent Registry should still be questioned. In effect, it should not be forgotten that the information contained in a patent is neither clear nor sufficient for somebody to benefit from it. And all these remarks leave aside the question of Venezuela's technological capacity, which is too weak to be able to use the registered information.

In summary, one can say that as a means for the diffusion of technical progress, the present patent regime must be questioned. This questioning must not be limited to more or less formal questions, such as, for instance, the organization of the archives, but also to central questions that would allow a technologically dependent country to improve its possibilities of using patented knowledge.

(c) The Patent System and Technology Transfer

A few years ago, specialized publications mistakenly singled out patents as one of the most important and efficient channels for technology transfer. What may be true for industrialized countries is not true at all when the receiving country is developing. In the latter case, patents cannot be considered to be by themselves channels for technology transfer, for several reasons.

First, patents only contain vague information. Second, the nonindustrialized countries lack the technological capacity and the industrial traditions that could enable them, in a given circumstance, to use the registered knowledge with no other support. As A.D. Tillet has said, developing countries can hardly use the patented information because it does not include anything about industrial production methods: it does not include how to build a factory or how to manage production; it does not include any guidelines for the correct estimations of costs and productivity; briefly, it provides very little industrial information.

Clear and direct evidence of the previous argument can be found by examining some technology transfer contracts signed by some Latin American countries. Only in very few cases were patents the only element. In Argentina, for instance, only 12 out of 200 firms signed contracts that did not include any references to operational know-how as well as blueprints, formulas, plant and product design engineering, administrative methods, etc. In Peru, the situation is similar: of 89 contracts examined, only

two referred exclusively to patent agreements.

In Venezuela, the evidence available from different sectors illustrates the general situation. In the pharmaceutical sector, 20 out of 87 contracts referred exclusively to patents. This figure is relatively high due to the specific characteristics of this sector. In the electronics sector, only two out of 26 contracts were exclusively related to patents.

Third, it is worth pointing out that a very high percentage of foreign patents are not utilized by the industries of the receiving country. It was not possible to obtain data on the situation in Venezuela, but Vaitsos' conclusions are valid in this country. In Colombia, according to Vaitsos, out of the 3,513 registered patents, only 10 had been exploited. In Peru, out of 4,872, only 54 were really being used in production.

One should also take into account an additional argument. Venezuela's legislation contemplates the expiry of patents 5 or 10 years after they have been granted. Also, it terminates the owner's right if the patent is not exploited within 2 years when there is no justification for the delay, or if exploitation is interrupted during the same period. If this occurs, the patent becomes freely available. Through such dispositions, as well as through the mechanism of compulsory licencing established in other countries, it is claimed that the less-industrialized countries could benefit from the registered foreign patents. A real technology transfer could take place, so it is claimed.

In the case of Venezuela, these assumptions do not apply for the following reasons:

(1) The situation in the Bureau of the Registration of Industrial Property makes it extremely difficult to know about unexploited patents.

(2) The Bureau is not capable of verifying whether the registered patents are being exploited or not and, consequently, cannot indicate whether they should become freely available or not.

(3) The patent owner can easily grant a false exploitation licence.

(4) The interested party may wish to avoid conflicts with the multinational firm that owns a nonexploited patent, either because it has beneficial relations with the multinational or because it prefers to observe the rules of the game that characterize an oligopolistic situation.

The patent system cannot be considered, therefore, as an effective instrument for the eventual utilization by nationals of the new processes and products developed abroad and registered in Venezuela. The system in practice serves other purposes and protects other interests.

Katz, on the basis of his own research and on studies done in other countries, points out that foreign firms take out patent rights to guarantee their participation in satisfying predicted demands. He says, in other words, that apparently the large production volumes of these firms generate optimistic expectations that induce "preventive" or "blocking" patents, so as to legally guarantee an acceptable participation in the predicted expansion.

Nevertheless, patents are only one of the means utilized by large firms for achieving such objectives and for preserving their rights over the innovations produced and registered abroad. Large firms have alternative means of defending themselves: cartel agreements, industrial secrets, etc. These alternative means are almost an automatic product of their enormous economic power and are more important than patents. In other words, patents must be seen only as a subsidiary mechanism for the support of highly oligopolistic market structures.

Patents should not be considered either as a fundamental condition for foreign investments to take place. Several studies have shown that if profound changes were made in industrial property laws, foreign investments would continue to flow. A study made by the U.S. Senate pointed out, for instance, that even if investors and their patent lawyers would like to have better protection from patents, the nature of that protection is rarely an important factor in the final decision on whether or not to invest.

The case of the Italian pharmaceutical industry is very revealing despite being a very specific sector. Even after Italy eliminated all patents for pharmaceutical products, its markets continued to attract foreign investors.

JOINT VENTURES AND TECHNOLOGY TRANSFER

The two cases analyzed in the STPI project concerning joint ventures between state firms, private local firms, and foreign firms have taken place in the petrochemical sector. This is quite understandable because the petrochemical sector is a highly sophisticated sector in technological terms, where even if there is a certain degree of competition among technology-supplying firms, there is probably a great deal of concentration among technology-generating and equipment-producing firms. These features have led the Venezuelan and Brazilian governments to search for foreign partners in the petrochemical business.

The joint venture in both cases is strictly limited to the productive investment but not to investments oriented toward creating technology-supplying firms, such as engineering firms. The participation of local engineering firms has been extremely limited and no relatively permanent business associations between local and foreign engineering firms were established. This fact by itself probably points at the most negative influence of the joint ventures examined, even when taking into account the dangers of open or covert takeovers of local engineering firms (or the possibility of the emergence of a "frontmen" kind of engineering firm).

Technology contracts have mostly been done in the package-deal form, with ineffective (and even dubious) biddings, without adequate efforts for international technology searches, and in the absence of developed engineering capabilities of the local partners.

This situation, in particular in the case of Venezuela where industry is younger than in Brazil, has limited local learning and posed severe problems to industry (interruptions in production, continued dependence on relatively minor technological services, etc.).

As a general conclusion, it must be said that the effectiveness of joint ventures as an instrument to promote local technological capabilities is probably more effective the more such local capabilities exist.

Joint Ventures in the Petrochemical Sector (Venezuela)

A new trend was given to national petrochemical development after 1966. The Venezuelan Petroleum Institute (IVP) is considered unable to cope on its own with all petrochemical development, and participation of the private sector, both national and international, is seen to be indispensable to the rapid and efficient development of the sector. Consideration is given to the importance of this industry in the generation of new areas of investment, and as an industry able to substitute imports and diversify exports.

In reality, investment in the basic petrochemical industry creates a need for other investments in the intermediate stage of the process, and these in turn imply the possible establishment of industries to transform petrochemical subproducts into products for final consumption. As regards import substitution, the conception of the structure of the complexes that integrate IVP and the resulting development of mixed companies is based on the idea of a vertical integration allowing for the substitution of a series of imported inputs, thus reducing the quantity of foreign currency leaving the country under this heading. Finally, based on the need to overcome the mono-exporting nature of Venezuela's economy and on the possibility of converting part of its primary products exports into the exportation of intermediate products derived from these, the planning of the new petrochemical plants includes the generation of enough surplus for this to be commercialized on the world market, thus allowing for diversification, in excess of the sector's limits, through final industrial products.

In the same year, 1966, the Congress of the Republic authorized IVP by law to engage in public credit operations amounting to 497 million bolívares. As a policy of development for the sector, the reserve of production of basic products was established for the state and that of intermediate products through mixed companies. Clear criteria were not at that moment established as regards the constitution of the mixed companies, nor regarding the percentage of participation of each of the investors or the part to be played by the state in the administration of the companies. The extension of the Moron Complex was then undertaken, primarily in the plants devoted to fertilizers, and the El Tablazo Complex made a contract with Kellogs.

Instruments of Regulation: The mixed companies appear in the national petrochemical industry on the basis of the new direction given to the development of the sector in 1966, which considered that it was impossible, given the specific characteristics of this industry, that IVP should continue to undertake its development alone.

The aims of the program of mixed companies included in the objectives of national development were as follows:

(1) To diversify the country's sources of foreign currency to compensate for the slow growth of petroleum exports.

(2) To increase as far as it is practical the added value from processing, which maximized the value of Venezuela's renewable natural resources.

(3) To increase figures of employment, though this is not an important characteristic of this country.

Interest in the creation of mixed companies including private capital was based on the private partner providing the following:

(1) International marketing capacity sufficient to permit production in the considerable volumes required by modern technology, to overcome in this way the disadvantage related to the lack of an international market of the required dimensions.

(2) Modern production technology, not only as regards the accumulated developments but also to allow for a continuous and necessary flow of future developments.

(3) Management capacity, to bolster the managerial and technical potential that IVP has achieved at present and may achieve in the future.

(4) Capital investments, which make for a more rapid and extended development of the petrochemical industry, and which unload IVP of the financial burden falling on it, in case it should have to undertake the development of this industry alone, which requires the use of considerable amounts of capital.

Although these are the criteria put forward as regards association with private capital in general, it is obvious that conditions of this type can only be provided, except for point (4), by the foreign private partner. Thus, fundamentally, these are the reasons for associating with the latter.

The void existing in relation to criteria regulating the sector led the IVP's Sub-Direction of Mixed Companies, composed of professional and technical personnel of proven experience, to establish certain minimum conditions for negotiation, which include those expressed in the law and cover other aspects that lack explicit regulation in the country. These minimum conditions are in fact those that should have defined the establishment of the mixed companies from 1970 on.

This team acknowledged the contracts of NITROVEN and UNICAR PETROQUIMICA and promoted and set up 11 new mixed companies. The minimum negotiating conditions established by the Sub-Direction of Mixed Companies were as follows:

(1) Foreign participation would cover up to 49% at most, depending on the volume of production set aside for exportation.

(2) The company's statutes should establish that in no case should fundamental decisions be taken without favourable vote of the IVP representation.

(3) IVP representatives must participate in the company's administration and to this effect mechanisms of participatory management and rotation of responsibilities are established.

(4) Sales on the national market will be undertaken by the mixed company or IVP.

(5) Sales on the international market will be made by the mixed company using as sales agent the international partner, IVP, and/or any other agent chosen by mutual agreement of the partners. IVP reserves the right to act as sales agent in negotiations to be effected with national and foreign governments.

(6) Agreements should stipulate, on the part of the company, a policy of formation of Venezuelan personnel in order that these may eventually fill the majority of posts at all levels.

(7) The future partners should not be directly or indirectly associated with engineering or equipment-manufacturing companies, to avoid a conflict of interests.

(8) Agreements should stipulate that the project should be established on the basis of bids by competing companies, and that the company should establish the type of contract involved.

(9) Each constituted company should devote no less than 1% of sales to scientific and technological research to be undertaken in Venezuela.

It is clear from the above that the mixed companies of the national petrochemical industry still lack sufficient explicit legal criteria for their regulation. The only instruments available to the Venezuelan state are the minimum negotiating conditions, which are established without any legal binding force by the IVP negotiating group.

In the mixed companies of this sector we perceive the reflection of the general situation already described, and also certain specific characteristics. The fundamental elements revealed by the analysis of the area are the following:

(1) The basic mechanisms and instruments required for the development of the sector are lacking; much less are there the mechanisms required explicitly for its technological development.

(2) The justifying criteria for the formation of mixed companies exclude the possibility of selecting the most suitable technology. The relative importance in these of the economic variables is far greater than that of the technological variable itself.

(3) The obliged exclusion of companies that are not producing companies but that have licences or patents, of companies acting in different markets, and of state research centres that own processes, reduces the level of competition in the process of selecting suppliers. This increases the appetites and the conditions imposed by the seller, which obviously diminishes the Venezuelan state's negotiating power.

(4) The fulfillment of some requirements, such as those concerning the minority participation of a foreign partner and the impossibility of taking decisions on the Board of Directors without IVP, merely gives formal strength to the state's decision-making power.

(5) The investment agreements, which are the only instrument IVP can use, have not in practice allowed it to control all the aspects intended. This in part may be the result of the weakness of the instrument, which is reflected in the vagueness of some of its clauses, and in part also of the fact that it has been impossible to obtain some of its objectives, such as the objective that the future partners should not be directly or indirectly associated with engineering or equipment-manufacturing firms, to avoid a conflict of interests. The viability of achieving this clearly depends on adequate interests, desire, and organization, which logically transcend these agreements.

One should, however, admit that these agreements are the only valid effort made so far to increase the Venezuelan state's negotiating and decision-making capacity, and they should be taken into account and strengthened for the future development of the sector.

The isolated and unsystematic efforts that have modified some of the aspects of the negotiation have led, even within the same framework, to positive results, which shows that it is possible to modify the negative conditions described above, at least in part.

(6) What has so far been analyzed is partly the reason for the kind of technology contracting in the sector, which is as follows:

(a) There is no rational process to obtain information or to elect and evaluate technological alternatives.

(b) There is no established form of bidding.

(c) Technology is obtained in package form, that is to say, tied to foreign financing, foreign investment, the possession of inputs, the possession of markets, etc. The main thread of this chain is the process's supplier, normally a partner of the company.

(d) Although the contracts apparently have different forms, it is evident that the negotiations follow a pattern that is fundamentally the same: technology is obtained without a complete breakdown being made, the technology is not really assimilated, restrictive clauses are included, items are paid for that produce no benefit, an extremely high economic and social price is paid, and there is no significant incorporation of

local components.

(7) From the point of view of scientific and technological activities, this type of contracting has the following consequences:

(a) It discourages the development of local engineering capacity and even results in lack of interest in already established resources, which abandon the sector.

(b) It discourages the capacity to adapt to and generate technologies, and fails to assimilate imported technology.

(c) It discourages the development of the human resources required in technology management.

(d) It discourages and fails to take advantage of the national capital goods industry.

In short, the technological behaviour of the mixed companies has contributed to strengthen dependence on the sector and their practical activity has established the patterns of this behaviour, since there is no guiding framework to establish them.

However, in the new phase of development that is beginning for the sector, some of the limitations have been overcome as regards guidelines, planning, and the promotion and protection of various aspects of national capacity. One should first point to the creation of a body having clearly defined planning functions as regards this sector, and also the reformulation of sectoral strategy defined in the V National Plan. It should also be pointed out, as regards the V National Plan, that its fulfillment by the public sector is obligatory, a fact that has special importance in Venezuela. But it should be noted that the basic argumentation used does not differ much from the policy followed so far, and that in addition it extends the field of mixed company participation in the industry. This may prove very dangerous if it is not accompanied by an adequate implementation and if the negative situations of the previous periods are not controlled. We suppose, optimistically, that the intentions that brought about the reorientation of the sector's development, along with certain elements of general control existing at present, should lead to a solution of the mistakes made in the past.

The fact that Decision 24 of the Cartagena Agreement has been made effective, whatever its faults, is a new element in control over mixed companies and over the contracting of technology in the sector, yet the Decision alone can achieve little, and for it to be effective, a series of complementary measures are required. There are some complementary measures that, although not necessarily sufficient, may over a medium term contribute to diminish the sector's technological dependence. Among these are the protection of national engineering companies, stimulus to the national capital goods industry as proposed in the V National Plan, the sectoral planning of scientific and technological activities, with regard to which petrochemicals is a priority sector, and the existence of the Industrial Credit Fund.

However, as regards the protection of the engineering companies, this has yet to be implemented, and the fact that they should have to be entirely national has also been seen to be a limitation, because participation in the foreign engineering companies themselves, if they were well controlled and taken full advantage of, would accelerate the development of national capacity. Local capacity is relatively low and, without expert guidance, can with difficulty be improved in a reasonable period of time.

As regards the capital goods industry, results will only be observable in the medium or long term, but there is an installed capacity in the country that is not used because the technology package is not broken up. The result of scientific and technological planning will also be visible only in the medium term, but this includes measures to take advantage of existing potential. Finally, because of the amount of investment in the sector, the Industrial Credit Fund will be unable to cover all of it, but will on the other hand represent an alternative and a strengthening of negotiating capacity in this regard. Besides, Venezuela is waiting for Decisions 84 and 85 of the Cartagena Agreement to come into effect, and these constitute an important support for a rational development of industry in general.

Finally, only a sovereign country can overcome technological dependence and a normative and institutional framework is insufficient for sovereignty to be achieved, because political determination is an indispensable element.

In nine of the 13 companies with part-foreign ownership, the know-how for the process and some of the engineering services are supplied by the foreign partner, who is generally paid with company stock. So 35% of the $46 million worth of capital with voting rights owned by foreign groups in the sector was integrated into the companies as technology. Apart from these contributions, the foreign partner can also be paid for the following:

- for transferring future developments in the process, the partner can be paid a fixed percentage of the company's sales for a minimum of 5 years;
- technical assistance in supervising the installation;
- in some cases, for acquiring and inspecting abroad;
- technical assistance in sales;
- use of the patented name in Brazil.

They also have the following responsibilities:

- to train experts from the Brazilian company in their factories abroad in operation, maintenance, and technical assistance for the consumer;
- to provide eventual marketing channels abroad for exporting Brazilian products;
- to supervise the selection of the companies that will provide the engineering services.

By acting in this way and with far less capital tied up than if they established an affiliate in Brazil, the foreign investors can obtain the facilities mentioned above and earn revenues from various activities and items such as using brand names, manufacturing under licences, etc., that would be forbidden under Brazilian law if the company were a subsidiary, and their capital investment turns out to be much more profitable. Moreover, marketing possibilities can be created by means of other mechanisms for companies the foreign investors have links with abroad.

The decisions each type of partner makes (PETROQUISA, the national group, and the foreign group) on technology and choosing it, while a project is being established, seem to be linked to the type of negotiating process that constituted the company and that will determine how the venture functions. Three general types of negotiations can establish a company:

(1) The initiative comes from a national group, which invests first, and if PETROQUISA decides to participate as a partner it will find the project already started.

(2) Two private groups, one foreign and one national, propose making the investment to PETROQUISA and the company is formed during the initial stage of the project.

(3) PETROQUISA takes the initiative in investing and determines the participation of the other groups.

The first two types of negotiations are characteristic of the period before COPENE was created, although PETROQUISA generally participated in the ventures founded by type (1) negotiations only after 1972. On the whole, its role in the majority of this type of company is to guarantee the control of the capital owned by national partners. In these cases, its influence over selecting technology is relatively small as two basic decisions will already have been made: the choice of the foreign partner and the production process. When this occurs, the foreign partner is generally more active in the chain of subsequent technological decisions.

Type (1) also includes the companies with no foreign partners, and these are almost the only cases when the Brazilian partner can control the principal stages of choosing technology.

Companies created by type (2) negotiations are the result of projects presented to the Industrial Development Council (CDI) to obtain fiscal incentive concessions and importing facilities. At this point PETROQUISA's participation is proposed. PETROQUISA tends to be more active in these companies than in the previous case. In general, two or three projects for the same project are presented to CDI and when the market will only take one more company, the project PETROQUISA decides to participate in is the one approved.

Type (3) reflects the orientation of PETROBRAS's most recent policy for the petrochemical sector. Evidently, in these companies PETROQUISA is the most important

partner in all aspects and when they decide to include a foreign group, the partner chosen is also the supplier of the know-how for the process and/or the basic engineering.

The second important stage in installing a project is when the company that will supply the know-how for the process is chosen. Generally, this choice is not very problematic, because there seems to be quite a lot of competition in the market of technology for petrochemical products. Of the companies studied, only five had had some difficulty in acquiring know-how, and this was because only two or three foreign companies supplied the technology to process the product they wished to manufacture. Nevertheless, in the other cases there were at least five international companies in selling the technology.

Obviously, the choice of the company that will supply the process is linked to how the company was constituted, because the principal reason why foreign partners participate in a venture is precisely to supply technology. Those companies that are not foreign owned or have a minimal percentage of foreign ownership use the same procedures to choose technology as those normally established to buy a generic input: quality, price, the guarantees offered by the seller, previous experience in similar plants, etc. In the other companies, the procedures vary according to the degree of competitiveness in the technology market. Evidently, when the technological knowledge is centered in the hands of a few groups of engineers, the choice of supplier will depend much more on whether one of them wants to participate in a venture in Brazil than on the selection criteria used by the Brazilian company. On the other hand, sometimes in the ventures where the supply of technology is competitive, there was no process of selecting the supplier as such, but one supplier got ahead of the international competitors by managing to form an association with Brazilian groups before the others could do so.

The international market of technology for petrochemical products is so competitive today largely because the knowledge in the sector has evolved very rapidly and dynamically and it is diffused very quickly within the economic system. These two variables have behaved in this way because of a technological peculiarity in the production plants where they have managed to discover the central characteristics of the technology of the production process relatively easily by understanding the basic engineering. In some cases it is even difficult to separate these two activities conceptually, because the innovations in the process are almost always integrated by changing the engineering process, and vice versa.

The third relevant stage in the decision-making process to choose a technology is when the roles the national and foreign engineering companies will play are decided. About 40% of the funds spent on engineering services were for contracts made in the country. There are at least four aspects concerning how the work is divided between the Brazilian and foreign engineering firms that deserve to be analyzed.

First, although the engineering firms in Brazil receive a significant number of the contracts in monetary terms, they are assigned the tasks that influence the choice of technology lease. In the overwhelming majority of the projects examined, the contracts granted to the national companies dealt with detailed work on the auxiliary units, construction and installation design, and utility systems, while the basic engineering and the details of the principal equipment were contracted abroad.

Second, a point that follows from the first, it is a short-term consequence affecting the next stage in installing the project: purchasing equipment. The competition in purchasing capital goods will be based on the specifications of the equipment supplied by the engineering firms, and if the specifications of the equipment are determined abroad, there are less possibilities that the national manufacturers can compete in supplying this equipment.

Nevertheless, perhaps the most important consequences of dividing the work between engineering firms abroad and in the country are medium and long term. If what was said before about the dynamism of technical progress in the petrochemical industry at an international level and the role played by the control over the know-how in the engineering activities is true, then it seems unlikely that the technology imported by the Brazilian petrochemical company will be absorbed or developed. One could say that to a certain extent these companies are being trained more to operate their factories than to manage and understand the know-how incorporated into the factories. This is because they have a very little contact with the central problems of the engineering and production processes. This is relevant, not so much because future expansions in the actual plant and/or important modifications in the productive process will still depend on new technology imports, but because the dynamic process of technological innovation is

offering an attractive opportunity that is being lost. This opportunity is that the new companies entering the market could stop being buyers and become sellers of technology relatively easily.

Finally, the last aspect that was observed in contracting engineering services perhaps mitigates a little the pessimism of the two previous points. The supply of these services in Brazil is very concentrated. Twelve of the projects analyzed had already chosen the engineering firm that would do the work in the country, and three companies will do nine of the projects. These contracts represent almost 74% of the budgeted value of the engineering services in the country for the 17 ventures. Besides, these three companies are most likely to be chosen for those projects where the engineering services have not yet been contracted out. Thus a nucleus of engineering companies (41) is being consolidated as a result of the growing petrochemical industry and although they are not important as far as absorbing technology is concerned, in the future they could become important instruments in surmounting the restrictions listed above.

Of all the results achieved in the initial stage, we should underline that a sophisticated industrial sector, which will probably operate with the most up-to-date techniques, where the companies will be in Brazilian hands without state monopolies having to be formed, is being established. At the same time, new types of links between the state company and the private groups were institutionalized, and they seem to be advantageous to everyone, at last in the beginning.

However, as only part of the possible results can be seen so far, some seemingly contradictory conclusions may be reached. For example, it may seem a mere formalism to say that a state monopoly (42) was not created because PETROQUISA has so much control over the sector that in practice it is already a monopoly. Furthermore, the public sector is the main source of funds for financing the projects, both in the case of direct investments and long-term financing. In this aspect, the petrochemical industry has broken a pattern that has existed throughout the Brazilian industrialization process, although it was only extended to the limit in recent years, and that is the absence of financing mechanisms capable of supplying the economy's investment needs from national sources. Despite the importance of the public sector's participation, the foreign partners seem to receive the largest share of the benefits.

If a longer-term view is taken, these results may stop being contradictory. They are only the short-term price that must be paid for the new system for importing technology, because the other alternative, to hand the sector over completely to foreign companies, would be much more harmful both in the long term and in the short term.

Nevertheless, the validity of this reasoning depends, to a great extent, on how the new institutional scheme will be used in the near future as an instrument to absorb and develop imported technology. For example, one possible way to do this would be to establish closer ties between the petrochemical companies and the engineering companies in the country.

An eventual association between these two types of companies would bring at least two levels of benefits. First, the petrochemical industry would have available a technical team whose job would be to learn about, systematically and in detail, the technology used in the factory. This team would be almost a research and development department with relatively low overhead costs, as these costs would be partly covered by the participation in the engineering firm's sales. The engineering firms would have another place to train their technicians, who would temporarily alternate in the research activities of the company. As their teams would be better trained and as the association would provide economic support, the engineering firms would be better able to expand their activities and probably solve one of the typical problems of this sector, which is the unpredictable sales. This process really has very obvious effects, because the stronger the engineering firm, the larger its contribution to developing technology in the petrochemical company.

The foreign partners will probably be against creating these links as they will attempt to maintain their control over the technology, which is the principal basis of their influence within the company. At the same time, if the source of this influence is neutralized, the strategies of the foreign investors in the sector will have to be redefined once again.

Apart from these suggestions, there are several other prospects for the petrochemical industry to develop technology, such as links with the research institutes,

relations with the capital goods industry, etc. Nevertheless, the long-term results will depend basically on how the available instruments are used by each of the agents of the process: the state, the national groups, and the foreign investors. And this will be the first test of an experience that will undoubtedly be repeated again in the Brazilian economy in the next few years.

Table 1: Effects of Policy Instruments.

Instruments	Technology		Nontechnology
	Embodied	Disembodied	
Imports	x		x
DFI controls	x	x	x
Licencing registries		x	
Patents		x	
Joint ventures	x		x

Table 2: Custom Duties: Common Applications and Corresponding Economic Policy Objectives.

Objectives	Applications
Full employment	Increase in import duties on those goods whose local production would stimulate the expansion of employment levels.
Price stability	Reduction in import duties on those goods whose local deficit would stimulate rises in their respective prices.
Expansion of production	Reduction in import duties on capital goods and/or intermediate products as a way of stimulating the expansion of the internal supply of finished products.
Protection or priorities	Increase or selective reduction in import duties on those goods whose local production it is wished to stimulate or inhibit respectively.
Improvement in the balance-of-payments (reduction of deficits)	Increase in customs duties on all or part of the goods from abroad as a way of inhibiting imports or compensating for the exit of foreign currency in some way.
Improvement in resource allocation (international division of labour)	Reduction in customs duties for those goods coming from given foreign countries where the availability of natural resources allows them to be produced in optimal conditions regarding quality, productivity, and prices.
Security of supply	Reduction in import duties on those goods whose local deficit would endanger the expansion of production or price stability of certain items considered basic or strategic.

Table 3: Nominal Tariff and Effective Implicit Protection for 10 Industrial Branches.

Industrial Branch	Nominal Protection (%)	Effective Protection (%)
Agriculture	6.2	6.4
Processed foods	29.6	20.1
Tobacco	49.7	30.9
Mining and energy	4.3	4.4
Intermediate products (basic chemicals, fertilizers and insectides, and synthetic fibers)	24.3	13.2
Intermediate products (soft textiles, pulp and paper, rubber, and basic metals)	36.6	27.7
Nondurable consumer goods	8.4	20.2
Durable consumer goods	40.8	48.9
Machinery	10.7	28.4
Transport equipment	18.0	26.0

Table 4: Tariffs and Official Prices for Some Capital Goods.

Tariff Heading*	Title	Ad Valorem Rate (%)	Official Price ($/kg)	Status for LAFTA Countries (%)
84.45 A 001	Universal centre lathes	25	25	Exempt
002	Turret lathes	"	36	"
004	Automatic lathes	"	5	3
005	Vertical lathes	"	"	
010	Grinding machines	"	"	3
011	Surface grinding machines	"	"	9
012	Universal grinding machines	"	"	6
84.45 B 025	Universal milling machines	"	"	7
026	Horizontal milling machines	"	"	
027	Vertical milling machines	"	"	
028	Shaping machines	"	"	2
030	Boring machines	"	"	
032	Planing machines	"	"	

Note: *All of these headings require import permits, except for imports from LAFTA members.

Sources: Tariff of the General Import Tax, Mexico, 1976.

Table 5: Percentage of Foreign Machinery of Firms Visited in Three Sectors.

Foreign Machinery	Capital Goods (%)	Petrochemicals (%)	Foods (%)
Total average	65	29	47
Average for users of Rule 14	66	35	49

Table 6: Imports of Capital Goods of Subsidiaries of Transnational Corporations in Five Industries.

Census Group	Industry	Value of Total Imports of all the Firms in Each Branch ($)	Transnationals Share of Imports of Capital Goods in Each Branch (%)	Number of Transnationals Included in the Calculation
20	Foods	271,091,100	1.6	3
31	Chemicals	2,514,156,600	4.64	12
35	Metal products	467,361,500	16.9	3(1)
36	Nonelectric machinery	943,107,000	32.2	8(2)
37	Electric machinery	1,099,518,600	40.0	7(3)

Notes: (1) The share of all imports of these 3 TC was 48%.
(2) The share of all imports of these 8 TC was 58%.
(3) The share of all imports of these 7 TC was 88%.

Table 7: Industrial Property and Creative Activity.

Reasons Why An Enterprise Carries Out R&D Activities	Capital Goods (15 enterprises)	Petrochemicals (15 enterprises)	Food Industry (14 enterprises)	Total
Possibility of generating patents	3	6	2	11
Pressure from competition	2	9	5	16
Instructions from head office	2	-	1	3
Need to reduce costs	4	11	6	21
Other reasons	5	7	2	14

Source: Direct research.

Table 8: Elements Most Frequently Found in Contracts of Technology Marketing in 37 Enterprises of Three Industrial Branches.

Number of Contracts Involved In:		Capital Goods	Petrochemicals	Food Industry
25	Patents	15	5	5
24	Trademarks	12	3	8
25	Technical know-how	14	8	2
34	Technical assistance	16	11	6
20	Engineering services	12	5	3
7	Administrative services	1	3	3
5	Others	3	2	-
140	(Sum of elements found in contracts)	73	37	27

Source: Direct research.

Table 9: Elements Included in 1310 Contracts in the Manufacturing Industry.

Elements	No. of Contracts	Percentage
Trademarks	779	59.5
Technical know-how	723	55.0
Technical assistance	531	40.5
Patents	315	24.0
Basic engineering	51	3.9
Administrative service	34	2.6
Detail engineering	20	1.5
Other services	48	3.6

Table 10: Branches in Which Patents Were Most Frequently Found in Contracts.

Industrial Classification	Nomenclature	Number of Contracts in Each Branch	Percentage of Contracts in Each Branch Involving Patents
29	Leather and fur	3	66
27	Cellulose-paper	19	42
33	Nonmetallic minerals	28	42
30	Rubber products	24	33
36	Nonelectrical machinery	136	30
26	Furniture	8	25

Source: See note (40).

Table 11: Subgroups in Which Patents Were Most Frequently Found in Contracts.

Industrial Classification	Nomenclature	Percentage of Contracts that Include:			
		Patents	Trademarks	Technical Know-how	Technical Assistance
318	Plastic articles	42	38	63	34
371	Electrical machinery	33	49	78	54
365	Agricultural machinery	33	53	46	53
311	Basic chemistry	32	26	73	73
383	Automobiles	31	50	62	47
315	Pharmaceutical products	27	75	50	28
372	Radio and TV sets	17	60	29	29

NOTES

(1) Decree No. 19,739, of 7 March 1931.

(2) In the past the increase in quotas has depended on an increase in exports, but this procedure does not seem to have any effect in this case.

(3) Finally, many manufacturers noted that corruption in customs was an important factor in the import of machinery - one with serious implications for local production. Moreover, the distributors of machine tools who operate in the country promote the sales of machinery from abroad, for they thus obtain higher earnings. National machinery is set aside, and its channels for commercialization are quite weak.

(4) B. Rey Romay, Posibilidades que ofrece la integración con América Latina para la fabricación de maquinaria y equipo, El Mercado de Valores, Num. 46, 17 November 1975. The figures come from the Statistical Annual on Foreign Commerce. On the development of the capital goods sector in Brazil, and the importance of the public sector in this process, consult Absorçao e criaçao de tecnologia na industria de bens de capital, FINEP, Brazil, 1974.

(5) Ammonium nitrate, ammonium sulfate, and urea are subject to the lowest rate: 5% on an official price of $1.15, $0.45, and $4.10 per kilogram respectively.

(6) The information comes from a list prepared by the Mexican Institute of Foreign Trade (IMCE).

(7) Moreover, a large portion of the firms that used Rule 14 had also used other exemptions: 29 firms out of 52 enjoyed other exemptions (and three more had applied for other exemptions).

(8) See Art. 28 of Decision 24 of the Commission, which established the Common Regulation of treatment of foreign capital and concerning trademarks, patents, licences, and royalties. The Foreign Investments Law does not even authorize, in any clear fashion, the Commission to limit profit remittances to foreign countries.

(9) See the corresponding note in Excelsior, 30 November 1972.

(10) This provision is not applied to those branches or sectors subject to specific regulation (Art. 6, LIE).

(11) The definition of what constitutes basic petrochemicals is a prerogative of the state. See the analysis of the Mexican Petrochemical Commission in the next subsection.

(12) Regarding the technological implications for state enterprises, see A. Nadal, El comportamiento tecnológico de la empresa estatal PEMEX, El Colegio de México, mimeo, 1975.

(13) An interesting aspect of the functioning of this mechanism is the following: the Commission dictates its resolutions and the Ministries of State are in charge of issuing the authorizations that relate to the resolutions. Moreover, CNIE is authorized to fix the proportion in which the bonds may be registered or payable to the bearer and to authorize or not the acquisition of bearers' bonds by foreigners.

(14) Bonds representative of capital owned by foreigners, trust funds in which

foreigners participate, and the resolutions of the Commission should also be registered.

(15) See RNTT's internal document, General criteria resume on the application of the Law on National Registry of Transfer of Technology and the use and exploitation of patents and trademarks.

(16) See UNCTAD's report, Transmission of technology, Third period of sessions, Santiago de Chile, TD/106, 10 November 1971. This information must be used carefully, because the statistics are incomplete.

(17) See K.J. Arrow, Economic welfare and the allocation of resources for invention, in The rate and direction of inventive activity, National Bureau of Economic Research, Princeton University Press, 1962, pp. 609-626. Besides, the acquirer very seldom has information on alternative sources of technology.

(18) For an analysis of this point, consult C. Vaitsos' work, Alternative strategies in the commercialization of technology: the underdeveloped countries' point of view, Cartagena's Agreement Meeting, Lima, October 1970. It is important to take into account that the technical know-how does not wear out with use.

(19) It is important to remember that these 47 contracts belong to engineering firms.

(20) The survey revealed that this practice is not unknown in Mexico. Out of the enterprises that had technology contracts, one declared having paid in equity. Obviously, this does not mean that this formula is the most commonly used.

(21) India constitutes a good example of how these aspects should be regulated. Capitalization of technology is limited to 10% of the equity but generally they try to avoid it; royalty payments are often limited to 5 years; finally, the imported inputs are discounted when the licensor participation in the equity is higher than 20%.

(22) According to the Registry's internal criteria.

(23) Such a committee could use INFOTEC's information on national suppliers of technology.

(24) This can be the only explanation for their violent criticisms concerning the RNTT Law and the attempts to update the legislation of industrial property. The irrationality of their positions is clearly seen if one takes into consideration that in fact they are criticizing legislation on the transfer of technology and patents that originated in the Sherman Anti-Trust Act, the Treaty of Rome, which gave birth to the European Economic Community, Brazil's Code of Industrial Property, and several instruments of Japan's industrial policy.

(25) See Article 8 of the RNTT Law.

(26) In any case it must be pointed out that in practice it might be very difficult to distinguish between improvements developed after signing the contract and development of new technologies.

(27) J. Alvaron Sobernais, Comentarios acerca de los criterios de aplicación de la Ley, expedidos por el Registro Nacional de Transferencia de Tecnología de México (Comments on different criteria on application of the Law, issued by the National Registry of Transfer of Technology of Mexico), La Propiedad Intelectual, No. 3, 1976, p. 168.

(28) For further development of this point, see F. Sercovich, Tecnología y control extranjeros en la industria argentina, particularly chapters 4 and 5.

(29) This type of bias sometimes takes the form of a vicious circle. For instance, preferences are given to local engineering firms provided that they can show reasonable previous experience. As they rarely fulfill this condition, they are

more often than not disqualified. And because they are disqualified, they cannot build the necessary experience. As a result, foreign-controlled engineering firms get the contracts.

(30) The U.S. firm was not prepared, for instance, to reduce the duration of the agreement from 10 to 5 years, expressly to reduce the licensee's partial freedom to compete in world markets, and refused to lower the royalty rate up to the 5% authorized by the Law as a maximum.

(31) Considering as valid the clause in point.

(32) Those clauses that may not be accepted concern mainly restrictions in procurement and marketing.

(33) Luis Guillermo Nieto Roa, Difficulties in the evaluation of technological contracts, Presentation to the seminar on the application and acquisition of foreign technology, Santiago, Chile, 1973.

(34) C. Freeman, The economics of industrial innovation, Penguin Books, 1974.

(35) New enterprises considered the fulfillment of these activities as indispensable in initiating their operations.

(36) Two in capital goods, five in petrochemicals, two in the food industry.

(37) The role of patents...The UNCTAD studies on this matter can also be consulted.

(38) This could explain the existence of a great number of licence contracts on unpatented (though not necessarily unpatentable) technical know-how.

(39) See C. Cooper, The mechanisms for transfer of technology from advanced to developing countries, Science Policy Research Unit, University of Sussex, study prepared for the ACAST and UNCTAD Secretariat, November 1970.

(40) The author wishes to thank Anthony Tillet for providing him with the list containing the information on 1,480 contracts. The sample was used in the abovementioned study on patents and was of great use in this research (particularly in the analysis of the National Registry of the Transfer of Technology). The sample was processed independently in both studies. Out of these 1,480 contracts, 1,310 belonged to enterprises from the manufacturing industry and 170 to extractive and services industries.

(41) Perhaps it is not very relevant to distinguish between the national and the foreign engineering companies established in the country, because the main asset these companies have is not their fixed capital in equipment, installations, etc., but how much accumulated experience the technical team has. Therefore, the most important concern should be how this technical knowledge is being used and adapted in the country.

(42) It is logical to insist on distinguishing between PETROQUISA's activities and those of the other state companies, principally because of PETROQUISA's relationship with the private groups in the petrochemical sector.

Appendix 1
INSTITUTES AND COUNTRIES PARTICIPATING IN THE STPI PROJECT

Argentina	Secretaria Ejecutiva del Consejo Latinoamericano de Ciencias Sociales (CLACSO) Country Coordinator: Eduardo Amadeo
Brazil	Financiadora de Estudos e Projetos (FINEP) Country Coordinator: Fabio Erber (until September 1974) and José Tavares
Colombia	Fondo Colombiano de Investigaciones Cientificas y Proyectos Especiales "Francisco José de Caldas" (COLCIENCIAS) Country Coordinator: Fernando Chaparro
Egypt	Academy of Scientific Research and Technology Country Coordinator: Adel Sabet (until July 1975) and Ahmed Gamal Abdel Samie
India	National Committee on Science and Technology Country Coordinator: Anil Malhotra (until June 1975) and S.K. Subramanian (until March 1976)
South Korea	The Korea Advanced Institute of Science (KAIS) Country Coordinator: KunMo Chung
Mexico	El Colegio de Mexico Country Coordinator: Alejandro Nadal
Peru	Instituto Nacional de Planificacion (INP) Country Coordinator: Enrique Estremadoyro (until February 1975) and Fernando Otero Technical Directors: Fernando Gonzales Vigil (until February 1975) and Roberto Wangeman
Venezuela	Consejo Nacional de Investigaciones Cientificas y Tecnologicas (CONICIT) Country Coordinator: Dulce de Uzcategui (until July 1974) and Ignacio Avalos
Yugoslavia (Macedonia)	Faculty of Economics, University of Skopje Country Coordinator: Nikola Kljusev

Appendix 2
SURVEY OF THE COUNTRY TEAM'S WORK

The organization, composition, and orientation of each of the country teams reflected the own interests and those of the institutions that hosted them, always within the framework of the STPI project concerns. A brief review of the approach and the work of each team may help to place the STPI project and the comparative reports in perspective. To complete the survey, a description of the field coordinator's office work is given.

ARGENTINA: The initial location for the Argentine team was the Department of Economics of the Catholic University. However, after some months, the university decided to withdraw its application and the country coordinator moved to the Argentine branch of the executive secretariat of the Latin American Social Science Council (CLACSO). The team was headed by Eduardo Amadeo, an economist, and two other members were appointed to work full time on the project. An advisory committee of several researchers and policymakers active in science and technology policy was formed. To carry out the research, the team relied on consultants who wrote reports on specific subjects that were integrated into a final report.

A significant change took place when the country coordinator was named president of the Instituto Nacional de Tecnologia Industrial (INTI), the national industrial technology institute, which is the largest and most important industrial research organization in Argentina. Mr Amadeo never relinquished his formal role as coordinator; after 6 months, he left his new post and resumed his position as country coordinator. Because most of the work was well under way, his absence did not substantially alter the team's pace, although the preparation of the Argentine synthesis report was postponed. Part of the team's work was reoriented to be most useful to the coordinator in his new position.

The Argentines focused on two branches of industry - machine tools and petrochemicals - but studied many broader issues. For instance, the reports include a document on the technological content of the 3-year development plan (1974-77), a study of the Argentine industrial structure, a description and brief analysis of technology policy instruments in Argentina, a study of the system for regulating technology imports, and several short reports on international technical assistance as an instrument of technology policy.

The structure of the Argentine scientific and technological system was studied in detail, as were the conditions under which it could be made more responsive to industry's needs. The Argentines covered the public sector, examining the possible role of the public sector as promoter of scientific and technological development. Detailed studies were carried out at two enterprises: one in charge of generating electricity in Buenos Aires (SEGBA) and the other in charge of generating and distributing gas for household and industrial consumption. Other contributions of the Argentine team were a study of the emergence and development of engineering and consulting firms in the chemical process industries, a detailed analysis of two research centres within the national industrial technology institute (INTI), and two short papers on capital accumulation and on the crisis of capitalism.

The Argentine team followed the methods guidelines; however, they produced a series of thematic reports on issues of actual and potential interest to policymakers in the country, coinciding with the themes selected for study in STPI.

BRAZIL: The Brazilian team was hosted at the research group of the Financiadora de Estudos e Projetos (FINEP), the state agency in charge of financing studies for investment projects and also the executive arm of the national fund for scientific and technological development. The first coordinator was the director of the research group,

Fabio Erber. When he took a leave of absence from FINEP in September 1974, he was replaced by José Tavares, the new head of the research group. The group at FINEP had been carrying out research on science and technology policy for some time, and the STPI assignment was one of its tasks for 1973-76. Practically all of the work was done by members of the FINEP research group, although two or three reports were contracted to professionals outside FINEP.

From the beginning, the Brazilians decided to concentrate on the role of state enterprises in technology policy. They chose branches of industry that were dominated by state enterprises (oil and petrochemicals, steel, and electricity), conducting detailed interviews, analyzing existing data, and testing hypotheses systematically to cover issues such as the selection of equipment and processes, the purchase of engineering services, the performance of research and development, and the planning activities at these state enterprises.

In addition to the new material generated by the Brazilian team during STPI, several reports based on past research carried out by FINEP were made available to the STPI network. These included background reports on the organization and structure of the Brazilian science and technology system, a study on the machine tool industry, a report on the demand for services of 12 research institutes, and a background report on industrial policies in Brazil during the last 2 decades.

In parallel with the work for STPI, the FINEP team was also engaged in a research project on the diffusion of technical innovations in three industrial branches (pulp and paper, cement, and textiles) and they agreed to put their results at the disposal of the STPI network as an additional contribution.

The Brazilian team used the guidelines only as a general reference, given that most of their work went along different lines from those originally envisaged for the project. Nevertheless, the richness and variety of their material effectively upgraded the comparative reports.

COLOMBIA: No Colombian participant was present at the initial organizing meeting, and the Colombian application to join the STPI network was received later and formally accepted at the Rio meeting of the coordinating committee. The team was hosted by the Colombian Council for Science and Technology, COLCIENCIAS, and was headed by a sociologist, Fernando Chaparro. In spite of joining the STPI network late, the Colombian team caught up with the pace of work and finished all its work by the deadline.

COLCIENCIAS organized a special team with five members who devoted practically all their time to research in STPI. Several other consultants were also asked to prepare reports on issues of specific interest such as selected policy instruments. For example, a study was commissioned on the impact of tariff mechanisms; a report was prepared on the influence of price controls; and a preliminary analysis of the possible use of the state's purchasing power as an instrument of technology policy was also prepared. The branches chosen for study were all linked to agriculture: fertilizers and pesticides, agricultural machinery, and food processing, taking into consideration the interests of Colombian policymakers as perceived by the team. In these branch studies, the methods guidelines were closely followed.

Other reports prepared by the Colombian team include a study of science and technology planning, an analysis of implicit industrial technology policies, a conceptual framework for the study of consulting and engineering organizations, a series of reports on industrial branches based on discussions with panels of experts, a study of science and technology policies in the agricultural sector (to complement the analysis done for industry), and two essays on the process of industrialization in Colombia and its technological implications.

Five groups of policy instruments were studied in detail, and their impact on each branch was examined through interviews at various enterprises. All of the findings were integrated into the final report of the Colombian team.

EGYPT: Although an Egyptian representative participated in the initial deliberations leading to the STPI project, it was not possible to organize the team to carry out

research and prepare inputs for the international comparison. There were several administrative difficulties and staffing problems that prevented the organization of a working team. The host institution was the Academy of Scientific Research and Technology and the first coordinator was Adel Sabet, who was replaced by Gamal A. Samie in July 1975. The Egyptian team presented papers that were personal contributions based on past experience rather than the result of research carried out by a team; and research was not begun at the academy until the second half of 1976.

INDIA: The host organization in India was the National Committee on Science and Technology, and the first coordinator was Anil Malhotra, who was replaced in June 1975 by S.K. Subramanian. Mr Subramanian resigned in March 1976, and no one replaced him. No funds were requested to set up a country team in India, and the Indians provided background material that had already been collected as background for a new science and technology plan.

Three background documents were distributed along with the final S & T plan to all the teams in STPI. In addition, a report on foreign collaboration, a note on science and technology planning in India, a survey of engineering consultancy services, a report on the development of the electronics industry, and two papers on small-scale industries and technology transfer were distributed by the Indian coordinator. No empirical research was done following the methods guidelines, and the Indian contribution to the comparative reports reflects this.

SOUTH KOREA: The South Korean team was one of the first to be organized and was established at the Korean Advanced Institute of Science, KAIS, as part of the activities of its science, technology, and society program. KunMo Chung was named country coordinator and the team consisted of five other members. All but one of them had other academic duties and could allocate only a portion of their time to STPI research. Then, Graham Jones was hired to advise in the preparation of the report for phase 1.

The South Korean team advanced rapidly and completed its work in time for the Sussex workshop, following the methods guidelines and introducing modifications only where necessary. Two reports were produced corresponding to the requirements for phases 1 and 2 of the project.

The branches chosen for study were electronics, petrochemicals, and powder metallurgy, and a report was prepared for each one. In addition, the team prepared documents on engineering services and industrialization in South Korea, on the Korean Institute of Science and Technology, on transfer of technology in the electronics industry, on the interface between the science and technology plan and the economic development plan, and on state enterprises in technical development.

Although most of the work was done by the team located at KAIS, consultants were asked to deal with specifics. The team predominantly represented engineering and physical sciences, but an economist who was a senior governement official, helped to relate the results to South Korean policymakers and to balance the other team members' biases.

MEXICO: The Mexican team was among the first to start working in STPI and was located at El Colegio de Mexico, an academic and social research and graduate training organization. Alejandro Nadal was country coordinator and there were four other members of the team who worked full time on STPI. The Mexican team initially followed the guidelines rather closely and was one of the first in suggesting modifications and changes as a result of contrasting concepts with preliminary research findings. In particular, the team found it difficult to interpret the results of interviews in enterprises using the schema proposed to study technological behaviour. The branches chosen for detailed study were capital goods, food processing, and petrochemicals.

A background report on the structure and evolution of the Mexican scientific and technological system was prepared, together with a description of the industrialization process and of agricultural development. Documents on particular subjects included a report on engineering firms, a study of the technology policy of PEMEX (the state oil monopoly), and progress reports dealing with hypotheses on the impact of policy instruments on technical behaviour at the enterprise level, a description of policy instruments in Mexico, etc.

Most of the findings of the Mexican team were integrated into the main final report, part of which was delivered at the coordinating committee in New Delhi (January 1976) and the rest at the Sussex workshop (June 1976). The work of the Mexican team covered practically all the research topics considered in STPI, and its contribution to the comparative report reflects this. The Mexican report was published in Spanish in 1977 and was awarded second prize in a contest for the best works in economics.

For various reasons, the Mexican team chose to limit its direct interaction with policymakers and followed its own research program. Results were made available to policymakers in the form of draft reports, and through the participation of the coordinator in one of the committees established to prepare the Mexican plan for science and technology.

PERU: The Peruvian team was established within the research group of the National Planning Institute. A series of administrative difficulties affected the progress of the team, including a change of technical director, when Fernando Gonzales Vigil was replaced by Roberto Wangeman in February 1975. Approximately two-thirds of the research was completed in time for the Sussex workshop.

From the beginning, the team decided to adopt a sectorial approach to the research. Efforts were focused on the study of industrial branches connected with the extraction and processing of minerals and with the provision of machinery for the mining industry. The steel industry was also studied, with emphasis on the state enterprise in charge of the largest steelworks. This meant that the guidelines were used primarily in sectorial studies and in the analysis of policy instruments.

Background reports on the situation of the scientific and technological system and on the evolution of Peruvian industry were prepared following the general framework put forward in the guidelines. In addition to these and the sectorial reports, the team prepared other documents, dealing with issues such as explicit and implicit science and technology policies, consulting and engineering capabilities, the possible use of state enterprises as instruments of technology, and the governement administrative machinery for science and technology policy.

The Peruvian team was located within an official government organization, but its direct impact on policymaking is difficult to assess because it took the form of daily contact with government officials. On the basis of the sectorial reports on mining, a committee has been set up to review the findings of the STPI team.

VENEZUELA: The Venezuelan team was hosted by the national council of science and technology (CONICIT) and was among the first to start working. The team was initially dominated by sociologists, although economists increased their participation at later stages. The first coordinator, Dulce de Uzcategui, was replaced by Luis Matos, who was soon followed by Ignacio Avalos. Three other members worked full time, and the team was biased toward sociology and economics.

They progressed through two stages punctuated by a change in government. In the first stage, most of the background reports corresponding to phases 1 and 2 of the STPI methods were prepared, covering the science and technology, the political, the educational, and the economic systems. These reports were made obsolete by the change in government. In the second stage, the team tried to adjust to the new situation, repeating some of the earlier studies and continuing the research. However, the organization of a national congress on science and technology, which mobilized all the staff working at CONICIT, affected the team's progress.

The branches chosen for study were capital goods, electronics, and petrochemicals. In addition, reports were written on specific issues such as the governement organizational structure for science and technology policy, instruments for industrial science and technology policy, economic and financial policy instruments and their impact on technology, the purchase of capital goods in two industrial branches, and the relations between the financial system and technology policy. The Venezuelan team concluded its research shortly after the Sussex workshop.

The fact that the Venezuelan team was located in a government agency that took

a very active role in science and technology policy after the change in government created both opportunities and problems. As a result of the new tasks undertaken by CONICIT, the pace and continuity of the STPI work was frequently altered. On the other hand, there was more possibility for actively contributing to policymaking. The Venezuelan contribution to the comparative reports reflects this situation.

YUGOSLAVIA (MACEDONIA): The Macedonian team was organized at the faculty of economics of the University of Skopje. A senior faculty member, Nikola Kljusev, was appointed coordinator. The team was composed of a very large number of faculty members and researchers who devoted part of their time to STPI. The tasks were subdivided and individual reports requested from various members of the team, although at a later stage two team members were asked to work full time on STPI.

The Macedonian team did not follow the guidelines, except in the preparation of a background report for phase 1. Individual reports were submitted on issues of interest to the STPI network, covering topics such as the problems of research and development in industrial enterprises, aspects of science and technology policy in Yugoslavia, the metallurgical industry in Macedonia, and the growth of engineering firms in Yugoslavia.

The Macedonian team's specificity is reflected in their relatively limited contribution to the comparative reports. At any rate, given the high degree of participation of professionals at all levels in policymaking in the Yugoslav self-managed economy, it is rather difficult to assess their contribution toward policymaking in conventional terms.

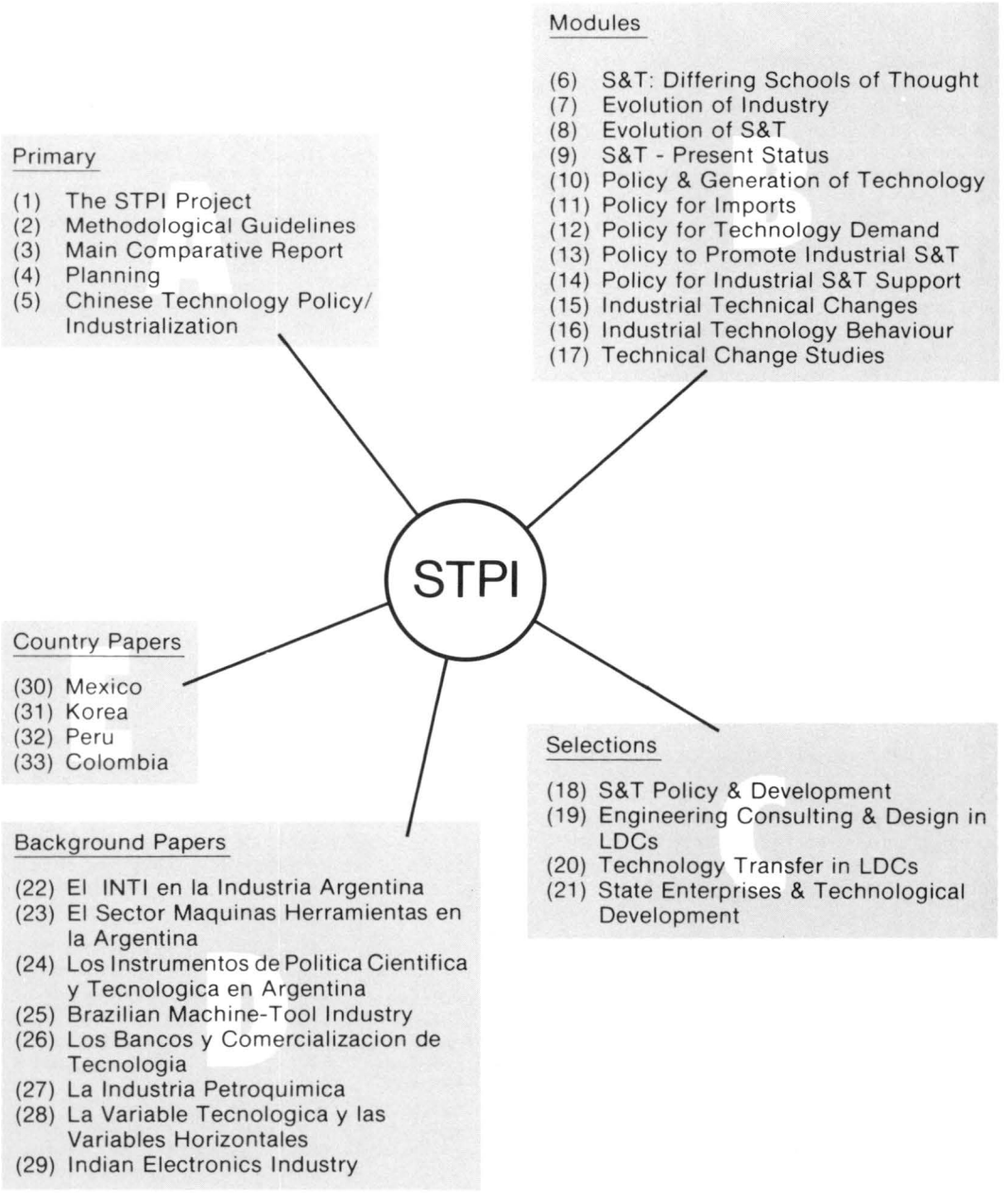
THE FIELD COORDINATOR'S OFFICE: In August 1973, at the first meeting of the coordinating committee, Francisco Sagasti was appointed field coordinator of the project and his office was established shortly thereafter and began operating in a limited way. Staffing was completed in April 1974 with the addition of two members.

The field coordinator's office was independent from the teams and was not engaged directly in empirical research. It offered organizational and technical support and contracted consultants to prepare reports on topics defined by the coordinating committee.

The field coordinator, first, drew up methods guidelines for phases 1 and 2 of the project. Background reports on technology policy in China, on technological dependence/self-reliance, on science and technology planning, on technology policies in Japan, and on technology transfer were also prepared, either by staff members of the field coordinator's office or by consultants. The guidelines for phases 3 and 4 of the project were prepared jointly by the field coordinator and a consultant. The office also organized the Sussex workshop and drafted the comparative reports. The field coordinator was also active in the board of the Peruvian Industrial Technology Institute (ITINTEC).

With the exception of the teams that were engaged in science and technology policy research as part of the activities of their institutions (the Brazilian and South Korean teams, for example), the teams were dismantled after the STPI project was completed. The field coordinator's office was closed in December 1976, and the comparative reports were prepared during 1977-1978, although some teams had not finished their work by April 1978. Even though most teams had concluded their STPI activities by the end of 1977, this does not mean that the team members left the field of S & T policy research and that their effort in STPI was not followed up. What was dismantled, as planned from the beginning, was the formal structure of the STPI project. The network of personal contacts remains in operation and most of the former team members are active in the field of science and technology policy, carrying the experience accumulated in STPI to their new positions.

Key to STPI Publications



A GUIDE TO THE SCIENCE AND TECHNOLOGY POLICY INSTRUMENTS (STPI) PUBLICATIONS

A. Primary Publications

(1) The Science and Technology Policy Instruments (STPI) Project (IDRC-050e) (out of print)

(2) Science and Technology Policy Implementation in Less-Developed Countries: Methodological Guidelines for the STPI Project (IDRC-067e) (out of print)

(3) Science and Technology for Development: Main Comparative Report of the STPI Project (IDRC-109e). (Also available in French (IDRC-109f) and Spanish (IDRC-109s).)

(4) Science and Technology for Development: Planning in STPI Countries (IDRC-133e)

(5) Science and Technology for Development: Technology Policy and Industrialization in the People's Republic of China (IDRC-130e)

B. Modules

These constitute the third part of (3) above and provide supporting material for the findings described and the assertions made in (3).

(6) STPI Module 1: A Review of Schools of Thought on Science, Technology, Development, and Technical Change (IDRC-TS18e)

(7) STPI Module 2: The Evolution of Industry in STPI Countries (IDRC-TS19e)

(8) STPI Module 3: The Evolution of Science and Technology in STPI Countries (IDRC-TS20e)

(9) STPI Module 4: The Present Situation of Science and Technology in the STPI Countries (IDRC-TS22e)

(10) STPI Module 5: Policy Instruments to Build up an Infrastructure for the Generation of Technology (IDRC-TS26e)

(11) STPI Module 6: Policy Instruments for the Regulation of Technology Imports (IDRC-TS33e)

(12) STPI Module 7: Policy Instruments to Define the Pattern of Demand for Technology (IDRC-TS27e)

(13) STPI Module 8: Policy Instruments to Promote the Performance of S and T Activities in Industrial Enterprises (IDRC-TS28e)

(14) STPI Module 9: Policy Instruments for the Support of Industrial Science and Technology Activities (IDRC-TS29e)

(15) STPI Module 10: Technical Changes in Industrial Branches (IDRC-TS31e)

(16) STPI Module 11: Technology Behaviour of Industrial Enterprises (IDRC-TS32e)

(17) STPI Module 12: Case Studies on Technical Change (IDRC-TS34e)

C. Selections

These are a selection of the numerous reports prepared for the STPI Project chosen as a representative sample of the various topics covered by the STPI Project in the course of the main research effort on policy design and implementation.

Science and Technology for Development: A Selection of Background Papers for the Main Comparative Report.

(18) Part A: Science and Technology Policy and Development (IDRC-MR21)

(19) Part B: Consulting and Design Engineering Capabilities in Developing Countries (IDRC-MR22)

(20) Part C: Technology Transfer in Developing Countries (IDRC-MR23)

(21) Part D: State Enterprises and Technological Development (IDRC-MR24)

D. Background Papers

(22) El INTI y el Desarrollo Tecnologico en la Industria Argentina (In press)

(23) El Sector Maquinas Herramientas en la Argentina (In press)

(24) Los Instrumentos de Politica Cientifica y Tecnologica en Argentina (In press)

(25) The Brazilian Machine-Tool Industry: Patterns of Technological Transfer and the Role of the Government (In press)

(26) Rol de los Bancos en la Comercializacion de Tecnologia (In press)

(27) Comportamiento Tecnologico de las Empresas Mixtas en la Industria Petroquimica (In press)

(28) Interrelacion Entre la Variable Tecnologica y las Variables Horizontales: Comercio Exterior, Financiamiento e Inversion (In press)

(29) A Planned Approach for the Growth of the Electronics Industry — A Case Study for India (In press)

E. Country Reports

(30) Instruments of Science and Technology Policy in Mexico (In press)

(31) Technology and Industrial Development in Korea (In press)

(32) Los Instrumentos de Politica Cientifica y Tecnologica en el Peru: Sintesis Final (In press)

(33) STPI Country Report for Colombia (In press)